

ENGINEERING REVIEW
of the
COLLECTION AND CONTROL SYSTEM DESIGN PLAN
from
City of Palo Alto Landfill; PLANT #2721
and
APPLICATION #2230

BACKGROUND

The City of Palo Alto owns and operates the active Palo Alto Landfill located at Byxbee Park adjacent to San Francisco Bay marshland and the Palo Alto Flood Basin. The site includes the following permitted equipment: S-1 Palo Alto Landfill with Gas Collection System abated by A-3 Landfill Gas Flare, S-5 Wood Grinder and S-7 Trommel Screen abated by A-5 Water Sprays, S-6 Diesel Engine (powering S-5), and S-8 Diesel Engine (powering S-7).

The Palo Alto Landfill is an active Class III Solid Waste Disposal Site. The site began accepting waste for open burning operations in the 1930s. Beginning in 1954, open burning ceased and landfilling began. Much of the older landfill areas were filled in marsh areas or the bay to extend the bay front land. After 1974, refuse was placed on top of existing refuse and raised the landfill height to 30 to 60 feet above grade. The refuse footprint occupies about 126 acres of the 136-acre disposal site. The total refuse depth varies down to about 75 feet. The maximum design capacity of the site is about 7,759,000 yd³ (total of all materials in the landfill) and 5,830,000 tons of decomposable waste. The site currently contains 4,580,000 tons of refuse as of December 31, 2002.

The landfill is equipped with an active gas collection system. About half of the collected landfill gas is sold off-site to an independently owned facility: WPI Packaging and Maintenance Company Gas Recovery Systems, Inc. (WPI). WPI (Plant # 9794) burns the collected landfill gas in two lean burn Internal Combustion Engines (S-1 and S-2). These two 1411 hp engines generate electricity to power WPI's packaging operations.

Any collected landfill gas that exceeds the capacity of the WPI's engines is burned in the City of Palo Alto's flare to destroy the methane, organic compounds, and TACs. This 30 MM BTU/hour Flare also acts as a back-up control device that is capable of handling all collected landfill gas in the event of a shut down of the WPI engines.

This application concerns the S-1 Palo Alto Landfill, gas collection system, and A-3 Flare at Plant # 2721. The main purpose of this report is the review and approval of the Collection and Control System Design Plan for this site. In addition, the City of Palo Alto has requested an Authority to Construct for an expansion of the gas collection system and for a Change of Conditions at the landfill and flare. This City has requested to install up to 30 vertical wells in the southwestern area of their Phase IIB fill area and the Phase IIC fill area after filling in these areas has ceased. The City has requested to correct an error in the peak daily waste disposal rate for the landfill. The City has also requested to modify the minimum required combustion temperature for the A-3 Flare based on the results of the District's October 9, 2003 source test on this flare.

This report will discuss (a) emission changes associated with the proposed installation of new wells and the proposed condition changes, (b) all changes to the MFR Permit that are necessary for the issuance of an Authority to Construct for new wells, for the approval of the condition changes, and for correcting errors, and (c) collection and control system design issues that were

identified in the December 2000 Design Plan but were not addressed in the MFR Permit and Statement of Basis for Site # A2721.

EMISSIONS

Particulate emissions from landfills are determined based on the waste disposal rate for the site. The sources of particulate emissions, which include vehicle traffic, excavation, disposal, and cover operations, and wind erosion, can all be related to the amount of waste disposed of per day. The District imposed Condition # 1028, Part 1a to establish a baseline waste disposal rate for this landfill. This baseline waste disposal rate was intended to be the same as the amount allowed by the Solid Waste Facility permit that was in effect prior to March 1, 2000. From the Solid Waste Facility permit that was issued on September 15, 1999, the first page of the permit states that the "average" permitted tons per operating day is 200 tons/day. However, Condition 17-6 of this permit states that the peak tonnage shall not exceed 400 tons/day. The District limit was intended to be the peak limit and not the average limit. The District is proposing to correct this error by changing the amount allowed in Condition # 1028, Part 1a. However, this change is not considered a modification pursuant to Regulation 2-1-234.3, because the landfill was allowed to accept waste at this rate prior to March 1, 2000. Since this change is not a modification and not subject to NSR, this application will not result in any cumulative increases in particulate emissions for the landfill.

Organic compound emissions from landfills are determined based on the cumulative amount of decomposable refuse that is placed in the landfill, the waste placement history, the resulting methane generation rate, and the capture efficiency of the landfill gas collection system. The maximum expected methane generation rate, the gas collection system capture efficiency, and the maximum permitted non-methane organic compound (NMOC) emissions from the S-1 Palo Alto Landfill are discussed in detail later in this report. Since this application will not increase the maximum permitted amount of decomposable waste or the future waste placement rate, this application will not impact the amount of organic compounds generated by the landfill. The installation of new wells will not affect the capture efficiency achieved by the gas collection system, because all collection systems that are meeting the requirements of Regulation 8, Rule 34 are assumed to achieve the same minimum capture efficiency (75%). The proposed installation of 30 new vertical wells at this site is intended to ensure that the Palo Alto Landfill continues to comply with the Regulation 8-34-303 surface leak limit and the Regulation 8-34-304 gas collection system installation date requirements. Therefore, the collection system capture efficiency and the maximum permitted NMOC emissions from this landfill will not increase due to this action.

Organic compound emissions from flares depend on the maximum permitted firing capacity and the minimum permitted control efficiency of the device. The flare temperature necessary to maintain the Regulation 8-34-301.3 NMOC emission limits ($T_{min.}$) is determined based on the average combustion zone temperature measured during a source test that shows compliance with the NMOC emission limits ($T_{avg.}$) and the EPA procedures described in 40 CFR Part 60, Subpart WWW ($T_{min.} = T_{ave.} - 50\text{ }^{\circ}\text{F}$). The current minimum temperature for the A-3 Flare (1470 °F) was established based on October 2002 source test data. New source test data is available that shows that A-3 Flare will comply with all applicable requirements at a lower minimum combustion zone temperature. The District conducted a test on the A-3 Flare on October 9, 2003. The average combustion zone temperature ($T_{avg.}$) during this test was 1470 °F. The source test results found that the flare was achieving 99.3% destruction of NMOC (minimum requirement is 98%) and emitting 6 ppmv of NMOC as methane at 3% O₂ (maximum exhaust concentration is 30 ppmv). NO_x and CO exhaust concentrations (3.3 ppmv and 21 ppmv, respectively) were also well below the limits of 32 ppmv of NO_x at 15% O₂ and 208 ppmv of CO at 15% O₂. Since the new test shows that A-3 will comply with all applicable requirements, the EPA equation above may be used to establish the minimum flare temperature ($T_{min.}$). The new minimum flare temperature should be: $1470\text{ }^{\circ}\text{F} - 50\text{ }^{\circ}\text{F} = 1420\text{ }^{\circ}\text{F}$. This action will not result in any changes to maximum permitted emission levels for the flare.

In summary, the proposed installation of 30 new wells, the proposed correction of the peak waste disposal limit, and the proposed new minimum flare temperature of 1420 °F will not result in any changes in cumulative emissions for this site.

MFR PERMIT REVISIONS

The proposed revisions to the MFR Permit are identified below in strikeout and underline format.

Section I Standard Conditions

The District discovered an erroneous date in Section I.B.1. The correction is shown below.

I. STANDARD CONDITIONS

B. Conditions to Implement Regulation 2, Rule 6, Major Facility Review

1. This Major Facility Review Permit was issued on December 4, 2003, and expires on November 30, 2008. The permit holder shall submit a complete application for renewal of this Major Facility Review Permit no later than ~~April-May 30~~1, 2008, and no earlier than November 30, 2007. **If a complete application for renewal has not been submitted in accordance with this deadline, the facility may not operate after** November 30, 2008. (Regulation 2-6-307, 404.2, & 409.6; MOP Volume II, Part 3, §4.2)

Section II Equipment

The peak daily waste disposal limit for the S-1 Palo Alto Landfill is listed in Table II-A, and the proposed revision to this limit is shown below.

Table II A - Permitted Sources

Each of the following sources has been issued a permit to operate pursuant to the requirements of BAAQMD Regulation 2, Permits. The capacities in this table are the maximum allowable capacities for each source, pursuant to Standard Condition I.J and Regulation 2-1-301.

S-#	Description	Make or Type	Model	Capacity
S-1	Palo Alto Landfill	Active solid waste disposal site that accepts municipal, commercial, industrial, and construction wastes.		Max. Waste Acceptance Rate = 2400 tons per day Max. Design Capacity = 7,759,000 yd ³ (5,932,000 m ³) Max. Cumulative Waste In Place = 5,830,000 tons (5,289,000 Mg)
	with Gas Collection System	active		92 vertical wells

The minimum combustion zone temperature for the A-3 Landfill Gas Flare is listed in Table II-B, and the proposed revision to this temperature is shown below.

Table II B – Abatement Devices

A-#	Description	Source(s) Controlled	Applicable Requirement	Operating Parameters	Limit or Efficiency
A-3	Landfill Gas Flare, Sur Lite, 30 MM BTU/hour, 1000 cfm of landfill gas	S-1	BAAQMD 8-34-301.3, see also Table IV-A	Minimum combustion zone temperature of 1470-1420 °F, see also Table VII-A	98% by weight destruction of NMOC or < 30 ppmv of NMOC, as CH ₄ , at 3% O ₂ , dry

Section III Generally Applicable Requirements

No changes to Section III will be necessary.

Section IV Source-Specific Applicable Requirements

As discussed in more detail in the initial Title V permit for this site (Application # 3047), the landfill and flare at this site are subject to the Emission Guidelines for MSW Landfills and Regulation 8, Rule 34. These operations are also subject to several other District regulations and permit conditions as identified in Table IV-A of the MFR Permit. The site history and applicable requirements were thoroughly reviewed and described in the Statement of Basis and the MFR Permit that were prepared for Application # 3047.

The proposed installation of new wells, the proposed flare temperature change, and the proposed waste disposal limit correction will be described in permit condition revisions, specifically revisions to Condition # 1028, Parts 1, 7, and 9. Parts 1, 7 and 9 are described in a general fashion in Table IV-A. Thus no changes to Table IV-A are necessary to include these condition revisions.

Section V Schedule of Compliance

No changes to Section V will be necessary.

Section VI Permit Conditions

All permit conditions modifications that were necessary to ensure compliance with the applicable requirements of Regulation 8, Rule 34 were discussed in the proposed MFR Permit and Statement of Basis for Application # 3047. The proposed permit condition revisions are now in effect with the issuance of the final MFR Permit on December 4, 2003.

As discussed above, the proposed installation of new wells, new minimum flare temperature, and waste disposal limit correction will require revisions to Condition # 1028, Parts 1, 7 and 9. The District is also proposing to correct a typographical error in Condition # 1028, Part 12. The proposed permit condition revisions are shown below.

Condition # 1028

For: S-1 PALO ALTO LANDFILL WITH GAS COLLECTION SYSTEM AND A-3 LANDFILL GAS FLARE

1. The Permit Holder shall comply with the following waste acceptance and disposal limits and shall obtain the appropriate New Source Review permit, if one of the following limits is exceeded:
 - a. Total waste accepted and placed at the landfill shall not exceed ~~2400~~ tons in any day. (basis: Regulation 2-1-301)

7. The Permit Holder shall apply for and receive an Authority to Construct before modifying the landfill gas collection system described in Parts 7a below. Increasing or decreasing the number of wells or collectors, changing the length of collectors, or changing locations of wells or collectors are all considered to be modifications that are subject to the Authority to Construct requirement.

a. The Permit Holder has been issued a Permit to Operate for the landfill gas collection system components listed below. Well and collector locations, depths, and lengths are as described in detail in Permit Application # 2230.

Required Components

Total Number of Vertical Wells: 92

b. The Permit Holder has been issued an Authority to Construct for the landfill gas collection system modifications described below. Well and collector locations, depths, and lengths are as described in detail in Permit Application # 2230.

	<u>Minimum</u>	<u>Maximum</u>
<u>Vertical Wells:</u>	<u>5</u>	<u>22</u>

Wells installed pursuant to subpart b shall be added to subpart a in accordance with the procedures identified in Regulations 2-6-414 or 2-6-415. The Permit Holder shall maintain records of the initial operation date for each new well.

(basis: Regulations 2-1-301, 8-34-301.1, 8-34-304, 8-34-305)

9. The combustion zone temperature of the A-3 Landfill Gas Flare shall be maintained at a minimum of ~~1470~~1420 degrees Fahrenheit, averaged over any 3-hour period. If a source test demonstrates compliance with all applicable requirements at a different temperature, the APCO may revise the minimum combustion zone temperature limit, in accordance with the procedures identified in Regulation 2-6-414 or 2-6-415, based on the following criteria. The minimum combustion zone temperature for the flare shall be equal to the average combustion zone temperature measured during the most recent complying source test minus 50 degrees F, provided that the minimum combustion zone temperature shall not be less than 1400 degrees F.

(basis: Toxic Risk Management Policy and Regulation 8-34-301.3)

12. Carbon monoxide (CO) emissions from the A-~~23~~ Landfill Gas Flare shall not exceed 208 ppmv of CO, corrected to 15% oxygen, dry basis.

(basis: Cumulative Increase)

Section VII Applicable Limits and Compliance Monitoring Requirements

The applicable limits and monitoring requirements necessary to demonstrate compliance with these limits were discussed in detail in the Statement of Basis for the initial MFR Permit for this site (see Application # 3047). The proposed changes to Condition # 1028, Part 7 do not affect any of the applicable limits or monitoring requirements identified in Table VII-A of the final MFR Permit. The proposed changes to Condition # 1028, Parts 1 and 9 are reflected in Table VII-A, as identified below.

The permit holder will continue to monitor the flare combustion zone temperature continuously, and this monitoring is adequate to show compliance with the new flare temperature limit. The permit holder will also continue to maintain daily waste disposal records, which is an adequate method of demonstrating compliance with the daily waste disposal limit.

The District is also proposing to correct a typographical error in Table VII-A as shown below.

**Table VII – A
Applicable Limits and Compliance Monitoring Requirements
S-1 PALO ALTO LANDFILL WITH GAS COLLECTION SYSTEM;
AND A-3 LANDFILL GAS FLARE**

Type of Limit	Citation of Limit	FE Y/N	Future Effective Date	Limit	Monitoring Requirement Citation	Monitoring Frequency (P/C/N)	Monitoring Type
Temperature of Combustion Zone (CT)	BAAQMD Condition # 1028, Part 9	Y		CT \geq 1470 1420 °F, averaged over any 3-hour period (applies to A- 3 only)	BAAQMD 8-34-501.3 and 507	C	Temperature Sensor and Recorder (continuous)
Amount of Waste Accepted	BAAQMD Condition # 1028, Part 1	Y		\leq 2400 tons/day and \leq 5,830,000 tons (cumulative amount of all wastes) and \leq 7,759,000 yd ³ (cumulative amount of all wastes and cover materials)	BAAQMD Condition # 1028, Part 17a	P/D	Records

Section VIII Test Methods

No changes to Section VIII will be necessary.

Section IX Permit Shield

No changes to Section IX will be necessary.

Section X Revision History

Section X was added to describe the revision history of the MFR Permit for this site.

X. REVISION HISTORY

Title V Permit Issuance: **December 4, 2003**

Minor Revision: **[insert approval date]**

- Corrected a date in Section I.B.1.
- Revised the minimum flare temperature in Condition # 1028, Part 9 and Tables II-B and VII-A based on new source test data.
- Corrected the peak waste disposal limit in Condition # 1028, Part 1a and Tables II-A and VII-A based on the Solid Waste Facility Permit for the landfill.
- Added text to Condition # 1028, Part 7 that describes the proposed vertical wells that the District is planning to issue an Authority to Construct for.
- Corrected typographical errors in Condition # 1028, Part 12 and Table VII-A.
- Added Section X Revision History and revised subsequent section numbers.

Section XI Glossary and Section XII Applicable State Implementation Plan

The section numbers for the Glossary and Applicable State Implementation Plan were revised as shown below.

XI. GLOSSARY

XII. APPLICABLE STATE IMPLEMENTATION PLAN

DESIGN PLAN REVIEW

Landfill Gas Generation Rates

Using waste disposal rates supplied by the applicant and the AP-42 default parameters for the LANDGEM program (for dry areas), the maximum methane generation rate for the Palo Alto Landfill was determined to be 396 cfm and occurred in 1994 (equivalent to 792 cfm of landfill gas at 50% methane). For the year 2003, the generation rate is expected to be 391 cfm of methane and 782 cfm of landfill gas at 50% methane.

The above generation rates were calculated by assuming that the waste disposal rate reported by the applicant was all decomposable waste. The early waste disposal history is not well documented and decomposable waste percentages are not known for much of the waste that has deposited at this site. Beginning in 1993, about two-thirds of the residential waste from Palo Alto was diverted to other landfills. Most of the recent waste is non-decomposable. Therefore, the waste disposal rates listed above likely over estimate the amount of decomposable at this site. Assuming that the percentage of decomposable waste is on average 60% (rather than 100%), the amount of landfill gas generated in 2003 could be as low as 469 cfm of landfill gas at 50% methane.

During the October 2003 source test, the landfill gas methane content was found to be 29.52% methane. Similar low methane contents have been found in other tests. Considering the poor quality (low methane content) of the gas that is currently being collected at this site, the lower landfill gas generation rate of 469 cfm that was determined above is the most realistic estimate of the gas generation rate for this site. This gas generation rate (469 cfm of landfill gas, which is equivalent to 235 cfm of methane) will be used for all other calculations for this site.

Collection System Design

BAAQMD Regulation 8-34-408 and 40 CFR Part 60.759 describe the design issues that must be addressed in Collection and Control System Design Plans. This section discusses the requirements for active gas collection systems. The control systems requirements, monitoring requirements and any proposed alternatives to the applicable regulations were discussed in the MFR Permit and Statement of Basis for this site.

Target Gas Collection Rate

Since 1993, the Palo Alto Landfill has been accepting mainly non-decomposable waste. Consequently, the gas generation rate at this site is declining even though the landfill is still active. The gas collection system at this site should be designed to handle 100% of the current generation rate. Specifically, the gas collection system should be designed to handle up to 469 cfm of landfill gas.

From AP-42 Chapter 2.4, the average landfill gas collection system efficiency for landfills is 75%. This collection system efficiency is used to establish a target gas collection rate for this site. For

year 2003, the target landfill gas collection rate is $(469 * 0.75) = 352$ cfm of landfill gas or 176 cfm of methane.

During 2002, the applicant reported collecting an average of 399 cfm of landfill gas. From the October 2003 source test, the average methane content for 400 cfm of landfill gas was 29.52% methane or 118 cfm of methane. This actual collection rate is only about 67% of the target gas collection rate for 2003. In order to improve the gas collection rate at this site, the City of Palo Alto is proposing to install a minimum of 5 and a maximum of 22 vertical wells in the newest fill areas. These wells are expected to collect an additional 50-110 cfm of methane. This should increase the total methane collection rate to a minimum of 168 cfm of methane and a maximum of 228 cfm of methane, which compare well with the target methane collection rate of 176 cfm and the expected methane generation rate 235 cfm.

Blowers and Gas Movers

The City of Palo Alto's gas collection system is equipped with two centrifugal blowers and each blower has a maximum capacity of 1000 cfm of gas. A single blower has sufficient capacity to collect all landfill gas that will be generated by this landfill.

Collection System Density

The area of influence around a gas collection system well (where the well can adequately collect the generated landfill gas) depends on the depth of the refuse and the strength of the vacuum that can be applied to wells without getting excessive air intrusion. Shallow and perimeter wells can typically achieve areas of influence with a radius ranging from 25-75 feet, while deeper interior wells generally have a larger radius of influence ranging from 75-175 feet.

For this site, the depth of the wells varies from 20-60 feet. Most of the wells are shallow wells, while a few wells in the center of the Phase IIA and Phase IIB fill areas are deeper wells. The distances between the vertical wells this site fall within the normal ranges discussed above for all closed areas. In the Phase IIC active fill area, the collection system density may not be sufficient. The City of Palo Alto has requested an Authority to Construct for 5-22 wells to address this issue. The addition of 5 wells in the southwestern area of the landfill is expected to provide the minimum collector density necessary to prevent surface leaks.

The District inspected this site for surface emission leaks after completion of the 2003 gas collection system expansion and after beginning to operate the flare. Nor surface emission leaks were found. Since the facility is now complying with the surface emission leak limit, the gas collection system density for existing fill areas is adequate.

Construction Materials

All collection system piping, valves, and connectors were constructed from approved materials, mainly HDPE in newer systems and PVC the older piping sections.

Other Design Issues

The newer collection system components are equipped with condensate traps and sumps and leachate collection and removal system. Condensate and leachate are pumped out whenever necessary, sent to storage tanks (exempt from permit requirements), and then transported off-site for treatment or disposal.

Control System Design

Collected landfill gas from the Palo Alto Landfill may be burned in either an on-site Landfill Gas Flare (A-3) or in the off-site energy recovery operations: S-1 and S-2 and Plant # 9794.

The off-site engine capacity is 21.6 MM BTU/hour (720 cfm of landfill gas at 500 BTU/scf or 360 cfm per engine) and the Flare capacity is 30 MM BTU/hour (1000 cfm of landfill gas at 500 BTU/scf). The capacity of the two WPI engines is sufficient to control all gas generated by the Palo Alto Landfill. The flare capacity is also sufficient to control all generated landfill gas. Since the current control system capacity is adequate for the remaining life of the collection system, no control system modifications are recommended at this time.

Alternative Limits

In the December 2000 Design Plan, the City of Palo Alto requested that some wells be exempt from the Regulation 8-34-305 vacuum requirements, nitrogen/oxygen concentration limits, and temperature limits. However, the City did not provide sufficient data to justify this request or to establish alternative limits. The City of Palo Alto is planning on submitting a new application soon that will include all the information needed to establish alternative wellhead limits. Note that the establishment of alternative wellhead limits will require a significant modification of the MFR Permit.

RECOMMENDATION

Staff recommends approval of the Collection and Control System Design Plan for the City of Palo Alto Landfill (Site # A2721), as proposed in the December 2000 Design Plan, except that no alternative wellhead limits are approved at this time.

Staff also recommends approval of an Authority to Construct for the modification described below and approval of a Change of Conditions for Condition # 1028.

- S-1 City of Palo Alto Landfill with Gas Collection System; abated by A-3 Landfill Gas Flare and off-site landfill gas combustion equipment at Plant # 9794.**
- **Modification to install a minimum of 5 and a maximum of 22 vertical wells in the southwestern area of the landfill.**

By: Carol S. Allen
Senior Air Quality Engineer

December 11, 2003
Date