ENGINEERING EVALUATION REPORT
SONOMA COUNTY CENTRAL LANDFILL
APPLICATION NUMBER 19313

BACKGROUND:

The Sonoma County Central Landfill (P# 2254) has applied for an expansion of their Landfill Gas Collection System S-1. The project includes the installation of approximately 4,500 linear feet of horizontal collector piping and associated header piping in an adjacent parcel of land to the east of the existing landfill. This new parcel known as the East Canyon is being developed in 3 phases for future landfilling operations. Phase I will be the installation of header piping and will be followed by the addition of horizontal collector piping in Phases II and III. Prior to any gas collection, the East Canyon will be connected to the existing Landfill Gas Collection System S-1 by a 12" pipeline.

The Gas Collection System S-1 is abated by (8) Internal Combustion Engines with a combined capacity to fire 2,522 scfm of landfill gas and (1) Flare with a landfill gas capacity range of 434 scfm to 1,330 scfm.

EMISSIONS CALCULATIONS:

Emissions from landfills with gas collection/processing systems consist of 2 parts; (1) fugitive landfill gas*, and (2) combustion emissions from the gas processing/abatement equipment.

> Landfill gas is essentially a 50/50 mixture of methane and carbon dioxide with traces (usually less than 1%) of precursor organic compounds which may include several toxic air contaminants. *(Ref. "Air Pollution Engineering Manual", Air & Waste Management Association; edited by Buonicore and Davis, pgs. 864-865, 1992)*

Combustion emissions for the (8) IC engines and flare have previously been accounted for, assuming that each will operate at its maximum potential firing rate. Therefore, any increase in the landfill gas generation rate will not affect the cumulative increase of combustion emissions at S-1 as long as the gas collection rate does not exceed the capacity of the system. Future landfill gas flow rate projections made by Sonoma County Central Landfill using the US EPA model for "Landfill Air Emission Estimation" in AP-42 Chapter 2.4, show a steady rise in gas generation to the year 2013 and then a steady decline. The highest gas generation rate at the landfill is projected to be 4,533 CFM.

AP-42 Chapter 2.4 states that landfill gas collection efficiencies typically range from 60 to 85%, with an average of 75% most commonly used. Therefore, a collection efficiency of 75% will be assumed for the Landfill Gas Collection System S-1.

At 75% collection, the highest flow rate into the collection system during the life of the landfill is projected to be 3,400 CFM, with a fugitive emission rate of 1,133 CFM. Therefore, the existing landfill gas combustion systems should have more than enough capacity (approximately 3,850 CFM combined capacity), so there is no cumulative increase of combustion emissions from the expansion. However, since fugitive emissions will increase, there will be a cumulative increase of emissions until the year 2013.

Fugitive POC Emissions

The District periodically samples and performs an analysis of the landfill gas at the Sonoma County Central Landfill. One of the components of the analysis is the amount of non-methane organic compounds (NMOC) in the gas. The NMOC results from 5 recent source tests are as follows:

Source Test #	NMOC (ppm as C1)
96140	2,400
97106	8,500
97162	700
98017	5,600
98055	2,600

From the above District source tests, the landfill gas at the Sonoma Central Landfill has an average NMOC content of 3,960 ppm (expressed as C1), with a high of 8,500 ppm and a low of 700 ppm. Using the average NMOC value and assuming as a worst case that all NMOC are precursor organic compounds (POC), the expected POC emissions at a maximum fugitive gas emission rate of 1,133 CFM will be as follows:

Given the following:

Molecular Weight of POC	12 lb/lb-mole (total carbon)
Volume of 1 Mole Gas	385 cu.ft./mole (@ 68°F and 1 atm)

POC = (3,960 E-6 lb-mole POC/lb-mole gas)(12 lb POC/lb-mole POC)(lb-mole gas/385 cu.ft.)(1,133 cu.ft./min)(1,440 min/day)

= 201 lb/day (total carbon)

Based on a recently measured flow rate of 2,150 CFM in the gas collection system and assuming an average collection efficiency of 75%, it is estimated that the current gas generation rate for the landfill is 2,867 CFM. With 25% of the total assumed to be fugitive emissions, the current estimated fugitive gas emission rate is 717 CFM. Therefore, using the same assumptions as above, the current fugitive POC emission rate is estimated to be:

POC = (3,960 E-6 lb-mole POC/lb-mole gas)(12 lb POC/lb-mole POC)(lb-mole gas/385 cu.ft.)(717 cu.ft./min)(1,440 min/day)

127 lb/day (total carbon)

Therefore, as a result of increased fugitive emissions, the landfill expansion is expected to increase POC emissions by 74 lb/day or 13.51 tons/yr by the year 2013.

CUMULATIVE EMISSIONS:

The ultimate cumulative increase for the East Canyon expansion as currently proposed is estimated to be:

(lb/day)		(tons/yr)	
POC	= 74.0	POC	= 13.505

TOXIC RISK ASSESSMENT:

Emissions of toxic air contaminants from this landfill are a combination of those found in the raw landfill gas (from fugitive emissions) and those in the combustion products of treated landfill gas.

The most recent District risk screen assessments for this site were conducted in June of 1995. At the time of the screens, it was estimated that the landfill had an overall gas generation rate of 2,987 CFM (2,240 CFM through the control system and 747 CFM fugitive). Risk screens were conducted assuming 2 idealized situations: (1) all collected landfill gas fired by IC engines; and (2) all collected landfill gas flared. For the most conservative risk estimate, calculated risk from the 2 scenarios were added together, then combined with the risk from fugitive landfill gas emissions to estimate the overall risk from the landfill.

It was found that the combined excess cancer risk (to the nearest receptor) of (8) fully utilized IC engines and (1) flare firing 2,240 CFM landfill gas along with 747 CFM of fugitive landfill gas emissions was 3.88 in one million. Of this risk, 1.3 in one million is attributed to fugitive emissions. (Ref. memo from Hari Doss via Dr. Pat Holmes, 06/27/95)

Since the risk from the engines and flare have previously been fully accounted for (to gas flow rates which have not yet been reached), the only increased risk to consider is from the projected increase of fugitive emissions generated from the East Canyon expansion.

The District has identified 7 toxic compounds in landfill gas samples from the Sonoma County Central Landfill and has established upper concentration limits in Permit Condition #6117 as follows:

<u>Carcinogens</u>

Benzene: 0.8 ppmv
Methylene Chloride: 2.0 ppmv
- Perchloroethylene: 2.1 ppmv
- Trichloroethylene: 1.2 ppmv
- Vinyl Chloride: 0.76 ppmv

<u>Non-Carcinogens</u>

- Methly Chloroform: 0.2 ppmv
- Toluene: 17.0 ppmv

Using these concentrations as upper limits and assuming an incremental landfill gas generation rate of 416 CFM, the mass emissions (lb/day) of each toxic compound from the East Canyon expansion are estimated as follows:

Given the following:

Molecular Weight (MW) of Benzene	78.1 lb/lb-mole
MW of Methylene Chloride	84.9 lb/lb-mole
MW of Perchloroethylene	165.8 lb/lb-mole
MW of Trichloroethylene	131.4 lb/lb-mole
MW of Vinyl Chloride	62.5 lb/lb-mole
MW of Methyl Chloroform	133.0 lb/lb-mole
MW of Toluene	92.1 lb/lb-mole
Volume of 1 Mole Gas	385 cu.ft./mole (@ 68°F and 1 atm)

Example Calculation:

Benzene = (0.8 E-6 lb-mole Benzene/lb-mole gas)(78.1 lb Benzene/lb-mole Benzene)(lb-mole gas/385 cu.ft.)(416 cu.ft./min)(1,440 min/day)

= 0.10 lb/day

Carcinogens

- Benzene: 0.10 lb/day
- Methylene Chloride: 0.26 lb/day
- Perchloroethylene: 0.54 lb/day
- Trichloroethylene: 0.25 lb/day
- Vinyl Chloride: 0.07 lb/day

Non-Carcinogens

- Methly Chloroform: 0.04 lb/day
- Toluene: 2.44 lb/day

In accordance with the District's risk management policy, a risk screen is required in order to determine the incremental risk associated with the landfill expansion area.

A risk screen conducted by the District found the incremental risk from the East Canyon expansion to the maximally exposed residential receptor to be 2 in one million. Therefore, in accordance with the District's risk management policy, the screen passes. *(Ref. Memo from Hari Doss via Pat Holmes, 3/3/99)*

Note:

The risk screen completed on 3/3/99 was based on emission rates approximately 40% higher than those shown above. The reason for this is that the fugitive emissions were originally based on a capture efficiency of 65% rather than 75%, which is now considered a more appropriate number. The higher emission rates evaluated in the risk screen only add to the conservatism of the risk estimate.

BACT REVIEW:

Best Available Control Technology (BACT/TBACT, "achieved in practice") for a Landfill Gas Gathering System is: "Horizontal and vertical gas collection lines vented to I.C. Engine or enclosed flare". *(Ref. BACT/TBACT Workbook, page 101.1, Revision 1, 10/18/91)*

The Gas Collection System S-1 abated by (8) Internal Combustion Engines and (1) Flare meets this requirement.

OFFSETS REVIEW:

For facilities with POC or NOx emissions between 15 tons/yr and 50 tons/yr, District Regulation 2-2-302 requires that offsets be provided by the District at a 1.0 to 1.0 ratio for all new emissions plus any pre-existing cumulative increase. Including the emissions from this application, the Sonoma County Central Landfill will have estimated facility POC emissions of 38.435 tons/yr. Therefore, POC offsets are required.

This facility has no pre-existing cumulative increase for POC emissions since 4/5/91, so offsets must only be provided for the emissions increase for this application. In order to receive POC offsets from the Small Facilities Bank all NOx sources at the facility must be equipped with Best Available Retrofit Control Technology (BARCT). The Sonoma County Central Landfill currently meets the BARCT gas collection and control requirements and surface emission requirements of Regulation 8, Rule 34 "Organic Compounds – Solid Waste Disposal Sites".

Since the facility has no available POC offsets credits and since all POC sources at the facility meet BARCT requirements, it is recommended that the required offsets be provided by the Small Facilities Emissions Bank in accordance with Regulation 2-4-414.

STATEMENT OF COMPLIANCE:

District Regulations
The Sonoma County Central Landfill is subject to the requirements of District Regulation 8, Rule 34 "Solid Waste Disposal Sites". The proposed East Canyon expansion is expected to comply with all applicable requirements.

NSPS
The East Canyon expansion is expected to increase the design capacity of the landfill beyond what they are currently permitted for by the State of California. Therefore, the New Source Performance Standard (NSPS) for Municipal Solid Waste Landfills (40 CFR 60, Subpart WWW) is now applicable. This standard requires a higher level of control for collected landfill gases and a more stringent surface emissions limit.

Under the federal standard, non-methane organics from collected landfill gases must be reduced by at least 98%, while the current District requirement is for total organics to be reduced by at least 98% by flares and by at least 97% with energy recovery devices. The surface emissions limit of Subpart WWW is 500 ppm as C1 at any location, versus 1000 ppm as C1, 7.5 cm above the landfill in Regulation 8-34. It is anticipated that the Sonoma County Central Landfill will meet these requirements.

CEQA
The Sonoma County Board of Supervisors, acting as the lead agency, certified the environmental impact report for modifications to the Sonoma County Central Landfill on December 8, 1998. *(Ref. Resolution #98-1524)*

PERMIT CONDITIONS:

No modification of the current permit conditions (Condition #4044) for this site are required for the proposed expansion of the Landfill Gas Collection System S-1.

RECOMMENDATIONS:

It is recommended that an Authority to Construct be issued to the Sonoma County Central Landfill as follows:

S-1: Landfill Gas Collection System -- East Canyon; Stage I and Stage II expansion of gas collection system, approximately 4,500 linear feet of horizontal collector piping and associated header piping

It is also recommended that 13.505 tons/yr of POC offsets be provided for this application from the District's Small Facilities Bank.

By: _____
Ted Hull
Air Quality Engineer II