Air Quality Permitting
Response to Public Comments

July 26, 2012

Permit to Construct No. P-2009.0001
Project 60792
Tier I Operating Permit No. T1-2011.0128
Project 60939

Ada County Solid Waste Management, Ada County Landfill
Boise, Idaho

Facility ID No. 001-00195

Prepared by:
Eric Clark, Permit Writer
Kelli Wetzel, Permit Writer
Cheryl Robinson, P.E., Modeling Analyst
AIR QUALITY DIVISION

Final

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1. BACKGROUND

As deemed appropriate by the Director, the Department of Environmental Quality (DEQ) provided for public comment regarding the proposed Permit to Construct, P-2009.0001 Project 60972 for Ada County Solid Waste Management from February 13, 2012 through April 9, 2012, in accordance with IDAPA 58.01.01.209.01.c. During this period, comments were submitted in response to DEQ's proposed action. Each comment and DEQ's response is provided in the following section. All comments submitted in response to DEQ's proposed action are included in the appendix of this document.

2. PUBLIC COMMENT AND RESPONSES

Public comments regarding the technical and regulatory analyses and the air quality aspects of the proposed permit are summarized below. Questions, comments, and/or suggestions received during the comment period that did not relate to the air quality aspects of the permit application, the Department's technical analysis, or the proposed permit are not addressed. For reference purposes, a copy of the Rules for the Control of Air Pollution in Idaho can be found at:

http://adm.idaho.gov/adminrules/rules/idapa58/0101.pdf.

Several comments were received, all of which fall under one of three categories. These include concerns about the increase of the permitted hydrogen sulfide concentration, odors related to the operations at the landfill and modeling-specific questions. The following response will address each of these areas individually in the subsequent paragraphs, followed by a summary of DEQ calculations. The actual comments received are attached in Appendix A.

Hydrogen Sulfide Concentration

DEQ received a pdf file as part of the comments which states the OSHA permissible exposure limit (PEL) for H_2S is 20 parts per million by volume (ppmv). Please note that the acceptable ambient concentration (AAC) increment listed for H_2S in Section 585 the Idaho Air Rules (IDAPA 58.01.01) is $1/20^{th}$ of this value: 20 ppmv = 14 mg/m^3, and 14 x $1/20^{th}$ = 0.7 mg/m^3 = 700 $\mu g/m^3$.

The 600 ppmv H_2S limit proposed in the Permit to Construct (PTC) is not what is being emitted from the flare or the engines. The 600 ppmv is representative of the maximum H_2S concentration in the Landfill Gas Collection System, measured at the header prior to feeding the landfill gas to Ada County Landfill (ACLF) flares or to Hidden Hollow Energy's engine generators. ACLF Flares 1 and 2 were designed to destroy 99.2% of the H_2S in the landfill gas. All but 0.8% of the H_2S is oxidized to SO_2 during combustion in the flares, resulting in an estimated maximum H_2S ambient concentration of 1.3 micrograms per cubic meter ($\mu g/m^3$).

Using very conservative assumptions suggested by a commenter, DEQ estimated that the equilibrium H_2S concentration above the uncapped 64 acres of the HHLF cell would be 0.38 ppmv (529 $\mu g/m^3$) at night, and 0.038 ppmv (52.9 $\mu g/m^3$) during the daytime. Offsite impacts from these fugitive H_2S emissions will be less than these values due to air inflow and dilution as the plume travels. Combining the maximum H_2S concentrations above the landfill cell with the maximum H_2S impacts from the flares, however, results in total offsite impacts of 530 $\mu g/m^3$ during nighttime hours (76% of the health-based AAC increment) and 54.2 $\mu g/m^3$ (7.7% of the health-based AAC increment) during the day.

In addition, the proposed permit has included stringent monitoring and recordkeeping requirements specific to H_2S whereas the current permit has none. Please see permit conditions 15 through 18 of the PTC and permit condition 4.12 through 4.15 of the Tier I operating permit for specific details.

A few comments asked specifically about the relationship between this project and Hidden Hollow Energy (Fortistar Methane Group). The permit limits the flow of gas to 3350 scfm. Of the 3350 scfm, 2400 scfm is intended to be burned in internal combustion engines operated by Fortistar Methane Group which is then converted to electricity. The remaining 950 scfm is flared. Therefore, the majority of the gas in the final permit is being used to generate power.

Other comments pertained to the pressure and oxygen content of the gas. There are a few reasons why Ada County Landfill is not maximizing the gas pressure. The more landfill gas extracted, the higher the oxygen content due to the landfill not being capped. 40 CFR 60, Subpart WWW limits the landfill to 5% oxygen and both the gas-to-energy system and the flare system optimize combustion at a lower oxygen content. The landfill

is meeting all state and federal regulatory requirements and at this time DEQ has no reason to require the landfill to extract the gas at a higher rate. As part of attempts to mitigate the current odor concerns, however, the landfill is considering increasing the amount of landfill gas collected in the system by increasing the vacuum from the blowers to the flares.

Ada County Landfill is currently expanding the number of wells to increase the area that is controlled by the gas extraction system. The piping from all the 66 new wells should be connected by September 26th, 2012. This should reduce the odors more so than increasing oxygen content and the suction rate of the system. The extraction system is required as a control mechanism for landfill gas in accordance with Subpart WWW. The installation of the system was not done to benefit Fortistar Methane Group. The control system was not put in to benefit the gas-to-energy system but rather to meeting the regulatory requirements of Subpart WWW. The landfill has the option to combust the gas in either the engines or the flare. Because the engines have higher combustion efficiency, the landfill has elected to combust the majority of the landfill gas in the engines.

Although a March 2, 2012 letter indicated that Ada County was going to install a hydrogen sulfide removal system, it was noted that this was a voluntary action. Since mid-2011, the measured H_2S concentration at the landfill gas header has been decreasing over time to levels below 600 ppmv. DEQ's analyses demonstrated that ambient impacts from combustion of the landfill gas and ambient impacts from fugitive emissions of H_2S from the landfill surface do not exceed applicable air quality standards for SO_2 or H_2S. On March 22, 2012, Ada County issued a letter to DEQ stating they had decided not to install the removal system at this time since it is not necessary to meet the permit requirements. If there are future modifications to the landfill, the installation of an H_2S removal system will be evaluated at that time. If the county were to install the removal system, they would still have the option to leave the H_2S limit at 600 ppm assuming no other changes were made to the facility.

Several commenters suggested that offsite monitoring should be conducted to determine offsite levels of H_2S. Monitoring is not economically feasible, however as required by Subpart WWW, the landfill is required to measure the concentration of methane on a quarterly basis. H_2S is found in trace amounts of the landfill gas (less than 1 percent). If the landfill exceeds 500 ppm methane at the surface three consecutive times, the landfill is required to install a new well to the collection system within 120 days. The landfill has done over 1,100 samples since 2007 and 99.8% of the time the methane is below 500 ppm. In addition, the landfill is installing 66 new wells to capture more landfill gas which will result in fewer fugitive emissions and ultimately fewer odors. Therefore, it is unnecessary for the landfill to monitor surface H_2S since they are already complying with the above requirement. As described in the calculations below, however, the monitored H_2S concentration in the landfill gas collection system and the measured methane concentrations at the landfill surface may be used to estimate fugitive emissions of H_2S.

Please see the attached memorandum that outlines the basis for the 85% collection efficiency used in the permit analysis. DEQ concurs with the conclusions. By assuming an 85% collection efficiency, DEQ is using a conservative number in regard to flare emissions. As described in the calculations below, however, DEQ estimated the potential fugitive emissions from the landfill cell presuming that only 50% of the landfill gas was collected by the extraction wells.

Odor Control, Odor Complaints, and Odor Sources

Many commenters raised concerns regarding an increase in odors from the landfill. As explained by landfill operators, the noticeable increase in odors from fugitive emissions from the landfill cell appears to be the result of several factors: 1) infiltration of water into the cell due to unusually snowy and wet conditions during the winter and spring of 2011, 2) disposal of larger than normal amounts of construction and demolition (C & D) wastes containing gypsum wallboard—which is typically comprised of roughly 50% sulfate—and similar materials during the housing boom that ended in about 2008, and 3) when gypsum drywall "becomes wet in a reducing environment, such as a landfill, sulfate-reducing bacteria (SRB) use sulfate as an electron acceptor to

produce H_2S."[1] Permit Conditions 10 and 14 in the PTC and 3.16 and 3.17 in the Tier I address odor requirements and complaints. Additionally, DEQ has an odor policy (DEQ Policy) to evaluate odor complaints.

Ada County Landfill is currently implementing the following procedures to mitigate the odors:

- Maximize landfill gas (LFG) from the LFG collection system by increasing the vacuum from the blowers to the flares.
- Wastewater sludge, a source of H_2S, is no longer disposed in the unlined Hidden Hollow Landfill (HHLF) cell.
- Wood chips recycled from the wood recycling operation are used on the intermediate cover areas of the HHLF Cell as additional cover to help control odor.
- 66 new LFG extraction wells have been drilled into the HHLF Cell to capture and extract more LFG. This should help reduce the amount of LFG escaping as fugitive emissions and is expected to result in a decrease in odors.
- Storm water drainage is managed on the HHLF Cell to drain storm water and snow melt off the landfill in a quick and efficient manner using a system of down drains, ditches, culverts, and a main concrete storm water ditch. Efforts are made to drain the precipitation off the landfill surfaces efficiently to reduce the infiltration of water into the waste. Several seasons of higher than normal precipitation saturated the HHLF causing an increase in the production of LFG. Efficient drainage prevents infiltration, thus slowing the production of gases from the degrading waste.

A specific commenter inquired about getting the air tested and the development of an Odor Addendum to the permit. Requiring monitors at the boundaries is an atypical approach and the cost of a Jerome meter is not economically feasible. As stated above, Ada County Landfill currently has several methods that they are employing to mitigate odors. In numerous conversations with the Boise Regional Office staff, these methods are equivalent to what would be required in an Odor Management Plan. Therefore, an odor addendum is not required at this time.

DEQ received a pdf file from a commenter that included a letter written to DEQ by Dee Conner on July 15, 2000 expressing concern regarding odors emanating from the Ada County Landfill. Additionally, the record of a complaint filed on February 14, 2012 to the Boise Regional Office was included in the PDF. In 2002, the Ada County Landfill submitted a PTC application. In 2004, the Ada County Landfill voluntarily put in the landfill gas control system. Odors were drastically reduced. In addition, since obtaining a permit, the landfill is subject to 40 CFR 60 Subpart WWW which requires the landfill to control the landfill gas through combustion.

The complaint filed on February 14, 2012 was evaluated by Boise Regional Office staff. Although the complaint that was filed was closed by the Boise Regional Office, the investigation is still ongoing as needed. The current odor issue is most likely due to the 66 new extraction wells that were drilled. It is anticipated that odors will be substantially reduced once the new wells are connected.

Commenters suggested that developing a real-time web-based odor reporting system using Twitter or similar technology would help improve communication between nearby residents and the landfill. DEQ currently maintains a web-based complaint and complaint tracking system. Complaints can be submitted via the DEQ website at the following link: http://www.deq.idaho.gov/environmental-concerns.aspx. Alternatively, complainants can contact JR Fuentes at the Boise Regional Office or Mike Reno at the Central District Health Department. They can be reached at (208) 373-0550 or (208) 327-8522, respectively.

A public records request can then be made by any member of the public if they wish to examine the outcome of a complaint. DEQ will continue to monitor the amount of odor complaints received. If, after September 2012

[1] Yang, et al 2006. Hydrogen Sulfide Generation in Simulated Construction and Demolition Debris Landfills: Impact of Waste Composition, Yang, Kenton, Qiyong Xu, Timothy G. Townsend, Paul Chadik, Gabriel Bitton, and Matthew Booth, Department of Environmental Engineering Sciences, University of Florida, Gainesville, FL., *J. Air & Wast Manage. Assoc.* ***56****:1130-1138.*

when all the new wells are connected to the control system, DEQ continues to receive odor complaints then DEQ may reopen the permit for cause.

Comments were received suggesting that combustion of H_2S and other compounds in the landfill gas might be contributing to the reported odors. As described above, 600 ppmv H_2S in the landfill gas combusted in the flares results in a maximum ambient H_2S impact of 1.3 $\mu g/m^3$ (0.0009 ppmv). Maximum impacts from combusting other reduced sulfur compounds (RSC, each presumed to be present at 600 ppmv in the gas) in the flares were each at or below 0.0009 ppmv. Modeled SO_2 impacts from combustion emissions, combined with a background value high enough to account for the maximum SO_2 concentrations formed by the reaction of fugitive H_2S with hydroxyl radicals in the air, were 184 $\mu g/m^3$ (0.07 ppmv)

DEQ compared the modeled and calculated H_2S, SO_2, and RSC ambient concentrations to published odor thresholds. The odor threshold ranges are the ranges where one can be expected to detect an odor. The H_2S (rotten egg smell) odor threshold ranges from 0.0005 ppmv to 0.3 ppmv (Agency for Toxic Substances and Disease Registry, 07/06). At 0.0011 ppmv,[2] the (rotten cabbage smell) odor threshold for methyl mercaptan is within the same range as H_2S, as is the (skunk smell) of tert-butyl mercaptan, at 0.001 ppmv.[3] The (rotten egg smell) odor threshold for carbon disulfide is quite a bit higher, at a reported 1 ppmv.[4] An odor threshold for carbonyl sulfide has not been established.[5] If concentrations of methyl mercaptan and tert-butyl mercaptan are present in such high concentrations in the collected gas, it is possible that emissions of uncombusted H_2S and reduced sulfur compounds are minor contributors to the reported odors from the landfill. None of these concentrations, however, exceed the applicable acceptable ambient concentration for these pollutants.

The odor of SO_2 has been described as pungent and irritating (imagine the smell of a just-struck match). The SO_2 odor threshold range has been reported to be between 0.67 ppmv and 4.75 ppmv (US EPA – Acute Exposure Guideline Levels for Hazardous Substances, 05/08). At 0.07 ppmv, the SO_2 concentrations resulting from combustion and fugitive emissions are an order of magnitude less than the lowest value odor threshold. SO_2 emissions from landfill gas combustion and from conversion of fugitive emissions of H_2S from the landfill surface do not appear to be contributing to the reported odors.

The primary source of the reported odors appears to have been from fugitive emissions of H_2S from the landfill surface. Using very conservative assumptions suggested by a commenter, DEQ estimated that the equilibrium H_2S concentration above the uncapped 64 acres of the HHLF cell would be 0.38 ppmv (529 $\mu g/m^3$) at night, and 0.038 ppmv (52.9 $\mu g/m^3$) during the daytime. During calm wind conditions, especially during evening and early morning hours when cooler air tends to flow downhill from the landfill, these concentration levels could certainly be expected to cause perceptible odors on nearby trail systems and in nearby residential areas.

Dispersion Modeling Analyses

Fugitive H_2S Emissions and Background SO_2 Level. Commenters brought odor issues to the attention of DEQ's permitting/modeling staff in February 2012, during the public comment period for this project. In 2011, DEQ had developed a 1-hour SO_2 background value for Boise of 33.1 $\mu g/m^3$ based on the following:

- SO_2 levels have not historically been monitored in the Boise area. An SO_2 monitor installed near the I-84 Meridian exit has been in operation since January 2009, but technical problems have precluded collection of sufficient data that meet completeness or quality requirements. For a qualitative discussion of anticipated background levels of SO_2 at the Ada County Landfill, however, it should be noted that the 1st high 1-hour SO_2 values from the St. Luke's Meridian location for 2009 through 2011 were 6, 8, and **12 $\mu g/m^3$**.

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[2] ISU 2004. The Science of Smell Part 1: Odor Perception and Physiological Response, Iowa State University, University Extension, accessed July 23, 2012 at http://www.extension.iastate.edu/Publications/PM1963A.pdf

[3] Chevron Phillips, accessed July 23, 2012 at http://www.cpchem.com/bl/specchem/en-us/Pages/tertbutylmercaptan.aspx.

[4] OSHA, Occupational Safety and Health Guideline for Carbon Disulfide, accessed July 23, 1012 at http://www.osha.gov/SLTC/healthguidelines/carbondisulfide/recognition.html.

[5] EPA 2000. Carbonyl Sulfide, Hazard Summary, accessed July 23, 2012 at http://www.epa.gov/ttn/atw/hlthef/carbonyl.html.

- A review of SO_2 monitor locations in other states determined that measured values collected in the Fargo-Moorhead area should be defensible but quite conservative (i.e., high) for the Boise area, based on the types of industry present, population, and the presence of a sugar processing plant using coal as a boiler fuel. The background value was set to the 1st high value over the years 2006 through 2008 (26.2 $\mu g/m^3$) plus one standard deviation of the 1st high values for each of those three years (6.9 $\mu g/m^3$) = **33.1 $\mu g/m^3$.**

DEQ used the assumptions suggested by a commenter, i.e., 50% efficiency for the landfill gas (LFG) collection system and 750 ppmv concentration of H_2S in the landfill gas, as well as surface methane monitoring results from the landfill, to determine the maximum contribution to SO_2 background levels from the conversion of fugitive emissions of H_2S to SO_2. Using conservative assumptions and worst-case conditions presuming no air flow over the landfill cell for more than an hour at a time, the maximum contribution to the SO_2 background level from fugitive H_2S emissions was calculated to be **19.4 $\mu g/m^3$** during daytime hours and **16.4 $\mu g/m^3$** at night. Combined with the first high monitored value over the past three years at St Luke's Meridian (12 $\mu g/m^3$), the total background during the day was **31.4 $\mu g/m^3$**, dropping to **30.1 $\mu g/m^3$** at night. This analysis confirmed that the background level of 33.1 $\mu g/m^3$ used for this project was reasonably representative for the landfill location.

AERMOD limitations for drainage flow conditions. Cold drainage flows typically occur during relatively calm wind conditions as temperatures cool into the evening hours. The cooler air tends to flow downhill following the terrain. This phenomenon applies primarily to ground level sources, e.g., fugitive emissions from the landfill surface. As described above, the equilibrium concentration of H_2S above the landfill surface—using very conservative assumptions—would likely result in detectable odors but would not exceed the health-based acceptable ambient concentration (AAC) increment for H_2S.

Like other Gaussian-based dispersion modeling programs, AERMOD cannot predict impacts associated with drainage flows over relatively small areas in steep terrain. Because of the thermal and momentum buoyancy associated with the releases from the ACLF flare stacks and engine generator stacks, however, these emissions will typically be well above the layer of cooler air stratification. As shown in Figure 1, the modeled results are more dependent on the prevailing wind directions than on the terrain. The maximum modeled ambient impact for combusting all of the landfill gas (3,350 scfm, with 600 ppmv H_2S) in the ACLF flares was 151 $\mu g/m^3$, at a location near Seamans Gulch Road just outside the southeast boundary of the landfill.

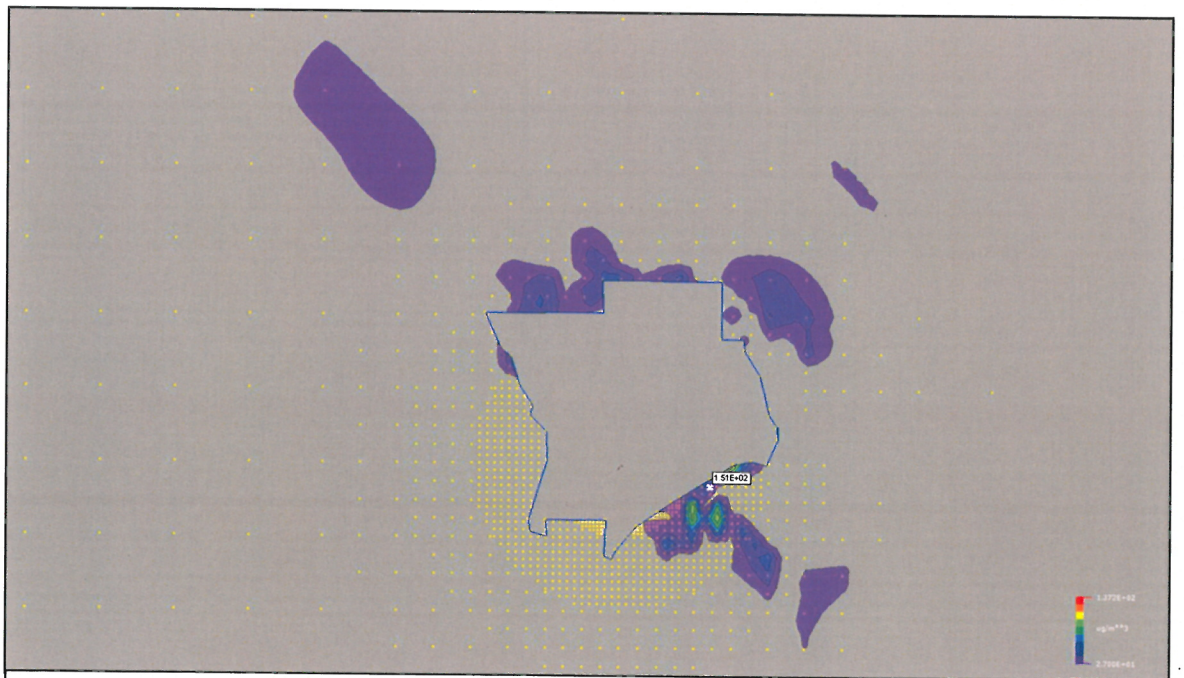

Figure 1. AMBIENT IMPACT CONTOURS FOR ACLF FLARE EMISSIONS

Receptor and Terrain Data Spacing. Dispersion modeling for air quality permits is not intended to determine concentrations at all locations surrounding a facility. The intent of a full-impact analysis is to ensure that the maximum design concentration at any point, combined with a representative background value, does not exceed an applicable state or federal air quality standard. The concentration of pollutants tends to become more dilute due to mixing with air as the plume travels, so modeling receptor grid spacing is typically denser near the source, with greater receptor spacing as the distance from the source increases. If modeled high values occur in areas where there is greater spacing between the receptors, additional receptors may be added in that area and the model rerun. Based on a review of the ambient impact contours, DEQ determined that the receptor spacing was sufficiently dense to reasonably resolve the maximum ambient impacts for this project.

Difficulties encountered attempting to download the 1/3-arc second data from what was then called the National Elevation Database (NED), combined with a tight deadline to complete the modeling to support Hidden Hollow Energy 2's timeline for obtaining funding to construct the second set of generators, prompted the use of the 1-arc second (30-meter resolution) terrain data. The commenter is correct that using 1/3-arc second terrain data with a resolution of approximately 10 meters, would have better characterized the steep terrain surrounding the landfill. However, given the limitations of the EPA-approved dispersion model for near-field and steady-state conditions (AERMOD), DEQ believes that the terrain data resolution was sufficiently dense to determine the maximum design value ambient impacts resulting from SO_2 emissions from the Ada County Landfill flares and from Hidden Hollow Energy's engine generators.

Please note that this was a somewhat unique case: DEQ does not ordinarily conduct dispersion modeling for applicants. However, given the time constraints; the benefits of combusting the landfill gas in the engine generators compared to routing the gas to the flares, i.e., better controlled combustion produces more complete combustion, yielding lower emissions of toxics and particulate matter into the airshed; the inherent delays associated with each applicant using their own consultant to perform these interrelated dispersion analyses; and the need for DEQ to then review and comment on two sets of analyses; DEQ opted to conduct the dispersion analyses for increased landfill gas H_2S concentrations for the ACLF Flares project and for the Hidden Hollow Energy engine generators.

Is meteorological data collected at the Boise Airport representative of conditions at the landfill? DEQ obtained raw meteorological data collected at the Ada County Landfill for the years 2007 through 2011 and processed the data as needed to import the data into a commonly used wind rose program WRPLOT View. The location of the existing weather station near the Household Hazardous Waste Building does not provide adequate separation from the building, the site does not meet EPA siting requirements for collecting valid meteorological data for dispersion modeling purposes, and the data do not meet minimum completeness requirements for use in atmospheric dispersion modeling. The data collected in 2007, prior to apparently repairing or replacing the weather station in late September of that year, were determined to be of questionable validity, so were not included in the wind profile graphics. The wind profile produced from the 2008 through 2011 data, however, is helpful for a general comparison with meteorological data collected at the National Weather Service (NWS) tower and Automated Surface Weather Observation Station (ASOS) at the Boise Airport.

As shown in Figure 2, the wind profiles at the landfill and at the Boise Airport are strongly bimodal and correspond with the northwest to southeast alignment of the Boise Valley. The bimodal direction of the wind rose from the landfill is rotated slightly compared to winds at the Boise Airport, but not substantially enough to warrant rotating the Boise met data wind field.

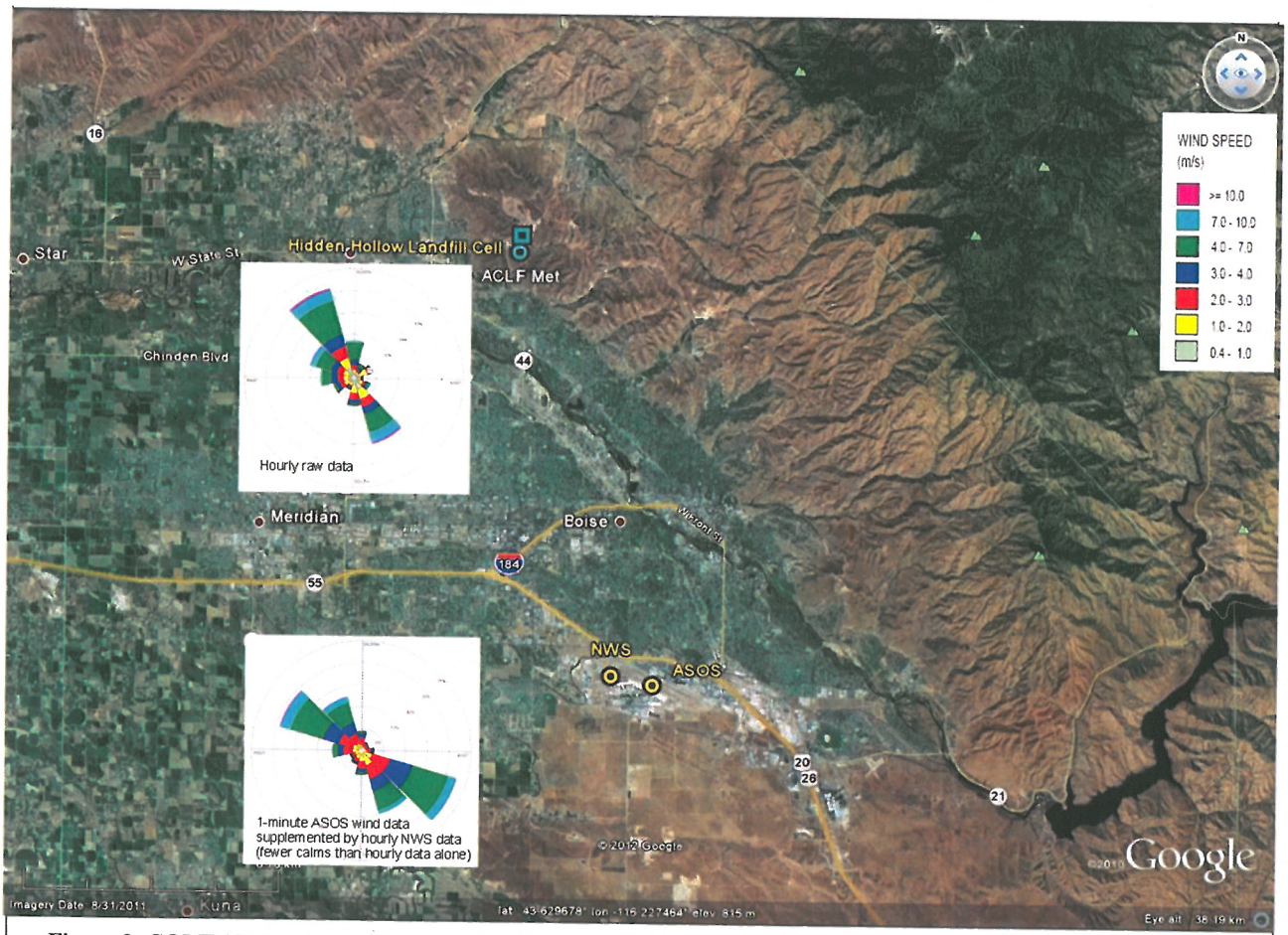

Figure 2. COMPARISON OF WIND ROSES FOR ADA COUNTY LANDFILL WEATHER STATION (2008-2011) and BOISE AIRPORT (2005-2009)

Calculations

1. Ambient Impact from uncombusted H_2S

Modeling for SO_2 emissions conservatively presumed that 100% of the H_2S was converted to SO_2 in the flares. Presuming an H_2S concentration in the landfill gas of 600 ppmv and feeding 3,350 scfm of landfill gas to the flares results in SO_2 emission rates of 10.2 lb/hr from each of the two flares. The highest first-high modeled ambient impact (i.e., the significance analysis result) for these SO_2 emission rates was 294 $\mu g/m^3$ at a location where the general public has access to the landfill during daytime hours.[6] A dispersion coefficient for the flare emissions can then be calculated as 294 $\mu g/m^3$ divided by 20.4 lb/hr = 14.4 $\mu g/m^3$ per lb/hr of emissions. Since 1 mole of SO_2 is produced from each mole of H_2S, the feed rate of H_2S is given by:

20.4 lb SO_2/hr x(34.08 lb H_2S/lb-mol H_2S) / (64 lb SO_2/lb-mol SO_2) = 10.86 lb H_2S/hr

H_2S emissions from the flares are equal to 10.89 lb/hr x (1 – 0.992) = 0.087 lb H_2S/hr

The maximum H_2S impact from flare emissions can therefore be calculated as

0.087 lb H_2S/hr x 14.1 $\mu g/m^3$ per lb/hr = **1.3 $\mu g/m^3$**

[6] DEQ project file: *ACLFPROP Flare12 600 ppm 3350 scfm ACLFPUBL Significant Receptors.xls*

2. Ambient Impacts from uncombusted organic reduced sulfur compounds (RSC)

Organic reduced sulfur compounds (e.g., methyl mercaptan, carbonyl sulfide, and carbon disulfide) are typically found in trace amounts in municipal solid waste (MSW) landfill gas, but at levels that are two to three orders of magnitude less than H_2S concentrations.[7] In testing conducted by Lee, *et al*[7] this was true for measurements of organic RSC at the surface of landfills that accepted large quantities of construction and demolition (C & D) debris. In samples from gas collection systems at C & D debris landfills, however, methyl mercaptan and carbonyl sulfide concentrations were greater than H_2S concentrations. In one sample, concentrations of isopropyl mercaptan and *tert*-butyl mercaptan were also greater than H_2S concentrations. For samples collected at the landfill surface, RSC concentrations were present at considerably lower concentrations than H_2S. The authors postulated that conditions deeper in the landfill were more favorable for the formation of organic RSC compared to locations nearer the landfill surface.

In light of this information, DEQ re-evaluated estimated emissions of methyl mercaptan, carbonyl sulfide, carbon disulfide, isopropyl mercaptan, and *tert*-butyl mercaptan from the ACLF flares. As shown in Table 1, predicted ambient impacts for RSC specifically listed in Section 585 of the Idaho Air Rules are well below the acceptable ambient concentration (AAC) increments, even when the RSC concentrations in the landfill gas are presumed to be equal to H_2S concentrations.

Table 1. ESTIMATED AMBIENT IMPACTS FOR OTHER REDUCED SULFUR COMPOUNDS (RSC)

Reduced Sulfur Compound	Conc. in LFG (ppmv)	LFG Feed Rate (scfm)	RSC Feed Rate (scfm)[a]	Mole Weight	Max Emission Rate (lb/hr)	Flare Destr. Effic.[b]	Flare Emissions (lb/hr)	Ambient Impact ($\mu g/m^3$)[c] *(ppmv)*	Idaho AAC ($\mu g/m^3$)	Percent of AAC
Carbonyl sulfide, COS CAS No. 463-58-1	600	3350	2.01	60.075	18.49	99.2%	0.15	2.13 *0.0009*	20	10.6%
Carbon disulfide, CS_2 CAS No. 75-15-0	600	3350	2.01	76.14	23.43	99.7%	0.07	1.01 *0.0003*	1500	0.1%
Isopropyl mercaptan, C_2H_7S CAS No. 75-33-2	600	3350	2.01	76.2	23.45	99.2%	0.19	2.70 *0.0009*	---	---
Methyl mercaptan, CH_3SH CAS No. 74-93-1	600	3350	2.01	48.11	14.80	99.7%	0.04	0.64 *0.0003*	25	2.6%
Tert-butyl mercaptan, $C_4H_{10}S$, CAS No. 75-66-1	600	3350	2.01	90.18	27.75	99.2%	0.22	3.20 *0.0009*	---	---

[a] Ideal Gas Law: PV = nRT → n = PV/RT. EPA standard conditions are 1 atm and 25°C.

$$1\ atm \times \frac{2.01\ ft^3}{min} \times \frac{.\ mol*K\ .}{0.08206\ L*atm} \times \frac{.\ 1\ .}{298.15\ K} \times \frac{28.317\ L}{ft^3} \times \frac{MW}{mol} \times \frac{60\ min}{hr} \times \frac{lb}{453.5924\ g} = [\ lb/hr\ ]$$

[b] Destruction efficiency per Table D6 of the ACLF application. If not listed, 99.2% was presumed.

[c] Dispersion coefficient = 14.4 $\mu g/m^3$ per lb/hr

[7] Lee, *et al* 2006. Reduced sulfur compounds in gas from construction and demolition debris landfills, Lee, Sue, Qiyong Xu, Matthew Booth, Timothy G. Townsend, Paul Chadik, and Gabriel Bitton, Department of Environmental Engineering Sciences, University of Florida, Gainesville, FL. *Waste Management* ***26****: 526-533.*

3. H_2S fugitive emissions estimated based on surface methane monitoring and LFG H_2S concentration of 750 ppmv.

Since April 2007, as part of implementing 40 CFR 60 Subpart WWW requirements, quarterly landfill surface methane monitoring has been conducted at each of the 529 points defined by a 100-foot grid across the entire surface of the Hidden Hollow Landfill cell. If the monitored concentration at a point exceeds 500 parts per million by volume (ppmv), additional sampling is required per Subpart WWW. If three consecutive samples collected at the same point per the sampling frequency specified in Subpart WWW, additional landfill gas control measures are required (e.g., installation of additional landfill gas extraction wells). In an April 12, 2012 letter to ACLF and DEQ the contractor responsible for conducting this monitoring reported that since April 2007 (21 quarterly sampling rounds), methane concentrations in excess of 500 ppm had been recorded only 18 times, and only one of these points had a repeat exceedance (CH2M 2012). Since February 2011, no measured concentration at any sampling point has exceeded 500 ppm. In the 46-acre capped area of the 110-acre landfill cell, measured concentrations of methane were routinely at or below 5 ppm to 20 ppm of methane (CH2M 2012).[8]

DEQ estimated fugitive emissions of H_2S from the Hidden Hollow Landfill cell using methane (CH_4) monitoring results and the conservatively high 750 ppmv H_2S concentration in the landfill gas suggested by the commenter. This approach eliminates the need to estimate the efficiency of the landfill gas collection system. The composition of landfill gas (LFG) was presumed to be about 50% methane (CH_4) and 50% carbon dioxide (CO_2). This assumption is reasonably conservative, as typical methane concentrations for HHLF gas have been reported to be about 43%.[9]

Fugitive Emissions from the Uncapped Landfill Surface Area (64 acres)

Given surface monitoring results ≤ 500 ppmv CH_4 in air

500 ppmv CH_4 + 500 ppmv CO_2	= 1000 ppmv LFG in air	=	0.1	percent LFG by volume in air
H_2S concentration in LFG	= 750 ppmv	=	0.075	percent H_2S by volume in LFG
H_2S concentration in air	= **0.75 ppmv in air**	=	0.0075	percent H_2S by volume in air

Convert to $\mu g/m^3$ at 25°C and 1 atm, $\mu g/m^3$ = 40.833 x ppmv x MW

H_2S concentration in air = 40.833 x 0.75 ppmv x 34.08 = **1044 $\mu g/m^3$**

= 149% of the 700 $\mu g/m^3$ H_2S AAC at the landfill surface*

* This results in an equilibrium concentration of 0.38 ppmv (**529 $\mu g/m^3$, or 76% of the AAC**) at night and 0.038 ppmv (**52.9 $\mu g/m^3$, or 7.6% of the AAC**) during daytime hours.

Check using alternate method:

V = nRT/P = 1.0 mol x 0.08206 L atm/mol K x 298.15 K/ (1 atm) = 24.466 L

$$\frac{0.75 \text{ g-mol } H_2S}{1 \times 10^6 \text{ g-mol air}} \times \frac{1 \text{ g-mol air}}{24.466 \text{ L}} \times \frac{34.08 \text{ g } H_2S}{1 \text{ g-mol } H_2S} \times \frac{1000 \text{ L}}{m^3} \times \frac{1 \times 10^6 \text{ µg}}{\text{g}} = 1045 \text{ µg/m}^3$$

Fugitive Emissions from the Capped Landfill Surface Area (46 acres)

Given surface monitoring results ≤ 20 ppmv CH_4 in air

20 ppmv CH_4 + 20 ppmv CO_2	= 40 ppmv LFG in air	=	0.004	percent LFG by volume in air
H_2S concentration in LFG	= 750 ppmv	=	0.075	percent H_2S by volume in LFG
H_2S concentration in air	= **0.030 ppmv in air**	=	0.0003	percent H_2S by volume in air

Convert to $\mu g/m^3$ at 25°C and 1 atm, $\mu g/m^3$ = 40.833 x ppmv x MW

H_2S concentration in air = 40.833 x 0.030 ppmv x 34.08 = **48.1 $\mu g/m^3$**

= 6.0% of the 700 $\mu g/m^3$ H_2S AAC at the landfill surface

[8] CH2M 2012. "Ada County Landfill Gas Collection Efficiency Basis, Title V Applicability Determination," Letter from Mssrs. Wirtz and McCormick, CH2M Hill, to Ada County Landfill and Idaho Department of Environmental Quality, April 11, 2012.

[9] Email, Hidden Hollow Emission Rates , Suparna Chakladar (Fortistar) to Kathleen Hieb (DEQ), October 7, 2009.

4. H_2S fugitive emission rates (Q_a) estimated based on 3350 scfm LFG collection, 50% collection efficiency, and LFG H_2S concentration of 750 ppmv.

Maximum predicted gas collection (at presumed 85% capture efficiency) = 3350 scfm LFG

Maximum predicted gas production = (3350/0.85) = 3940 scfm LFG

Maximum fugitive emissions from cell surface at 50% capture efficiency = 1970 scfm LFG

H_2S emission rate:

$$1970 \text{ scfm LFG} \times \frac{750 \text{ parts } H_2S}{1 \times 10^6 \text{ parts LFG}} = 1.48 \text{ scfm } H_2S$$

Ideal Gas Law: PV = nRT → n = PV/RT. EPA standard conditions are 1 atm and 25°C.

$$1 \text{ atm} \times \frac{1.48 \text{ ft}^3}{\text{min}} \times \frac{\text{mol} * \text{K}}{0.08206 \text{ L} * \text{atm}} \times \frac{1}{298.15 \text{ K}} \times \frac{28.317 \text{ L}}{\text{ft}^3} \times \frac{34.08 \text{ g } H_2S}{\text{mol}} = 58.3 \text{ g/min}$$

Uncapped Area: Q_a = 58.3 g/min x 64 acres (0.75 ppmv)/(64*0.75 + 46*0.03) = **56.7 g/min** (97.3%)

Capped Area: Q_a = 58.3 g/min x 46 acres (0.03 ppmv)/(64*0.75 + 46*0.03) = **1.6 g/min** (2.7%)

5. H_2S conversion to SO_2

In the troposphere (the lowest region of the atmosphere beginning at the earth's surface), hydrogen sulfide reacts with hydroxyl radicals (OH^-) to produce hydrosulfide ions, then reacts with oxygen (O_2) to form sulfur oxide (SO). Further reactions with oxygen or nitrogen dioxide (NO_2) yield sulfur dioxide (SO_2). The chemical reaction can be represented as follows:

$$H_2S \xrightarrow{OH^-} HS^- \xrightarrow{O_2} SO \xrightarrow{O_2 \text{ or } NO_2} SO_2$$

The concentration of hydroxyl radicals during the day is typically an order of magnitude greater than nighttime concentrations.[10] Formation of the hydroxyl radical depends in large part on photolysis of ozone and reactions with nitrogen oxides, so conversion of H_2S to SO_2 typically occurs during daytime conditions rather than at night.

Although H_2S will react with available oxygen, DEQ's review of the literature indicates that atmospheric conversion of H_2S to SO_2 depends primarily on the availability of hydroxyl radicals. "Degradation of hydrogen sulfide in the atmosphere can occur through oxidation by oxygen (O_2) and ozone (O_3) to give sulfur dioxide (SO_2), and ultimately, sulfate compounds. Sulfur dioxide and sulfates are eventually removed from the atmosphere through absorption by plants and soils or through precipitation. Hydrogen sulfide in air can also react with photochemically-generated hydroxyl radicals. The effective life-times for hydrogen sulfide based on summer daytime and yearly average hydroxyl radical concentrations have been estimated to be 0.23 and 2.3 days, respectively, based [on] a measured rate constant of 4.8×10^{-12} cm^3/molecule second. Life-times in air ranging from approximately 1 day in the summer to 42 days in the winter (for a site located at 55^0 north latitude) have been estimated for hydrogen sulfide. Hydrogen sulfide is not expected to be decomposed by direct absorption of ultraviolet radiation, and the reaction with ozone is not expected to be a significant environmental fate" (ATSDR 2006).[11] Estimated lifetimes of H_2S in the atmosphere are summarized in Table 2.

[10] Felton 1988. "Measurements of the diurnal OH cycle by a 14C-tracer method," Felton, Colin, J.C. Sheppard & M.J. Campbell, Washington State University, *Nature* **355**: 53-55.

[11] ATSDR 2006. "Toxicological Profile for Hydrogen Sulfide," U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, July 2006, accessible at http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=389&tid=67

Table 2. RESIDENCE TIME FOR HYDROGEN SULFIDE IN THE ATMOSPHERE LITERATURE SEARCH RESULTS	
Residence Time	**Source**
0.23 days, summer daytime	ATSDR H_2S Toxicological Profile (ATSDR 2006)
Mean is approximately 18 hours [a]	ATSDR TOXFAQs™ for Hydrogen Sulfide
Half-life due to reaction with OH^- 2.1 days [a] Lifetime " " : 3.0 days [a]	California Air Resources Board (CARB)
1.7 days in the presence of ozone levels of 0.05 $\mu g/m^3$ [a] 2 days in relatively clean air [a]	World Health Organization, Environmental Health Criteria 19, Hydrogen Sulfide
3.0 days [a]	Iowa State University and the University of Iowa Study Group Report (Feb 2002)

[a] James Bowyer, February 6, 2003, accessible at http://daq.state.nc.us/toxics/studies/H2S/H2S_Ambient_Air.pdf

Conversion of H_2S to SO_2 in air can be estimated as a first order chemical reaction, i.e., the conversion rate is proportional to the amount of H_2S available. This can be expressed as follows:

$$\text{Concentration of } H_2S \text{ at any time (t)} = \text{Initial Concentration} \times e^{-kt}$$

The rate constant, k, can be determined using the residence time in the atmosphere, as follows:

$$k = \ln(2) / t_{1/2} \quad \text{and}$$

$$\text{Half-life, } t_{1/2} = \ln(2) \times \text{Residence Time, so}$$

$$k = 1/\text{Residence Time}$$

As H_2S is converted to SO_2, the concentration of H_2S in the air decreases as the SO_2 concentration rises, as shown in Figure 3 for retention times t_R of 0.23 days (5.52 hours), and 3 days (72 hours) with initial H_2S concentration equal to 0.75 ppmv.

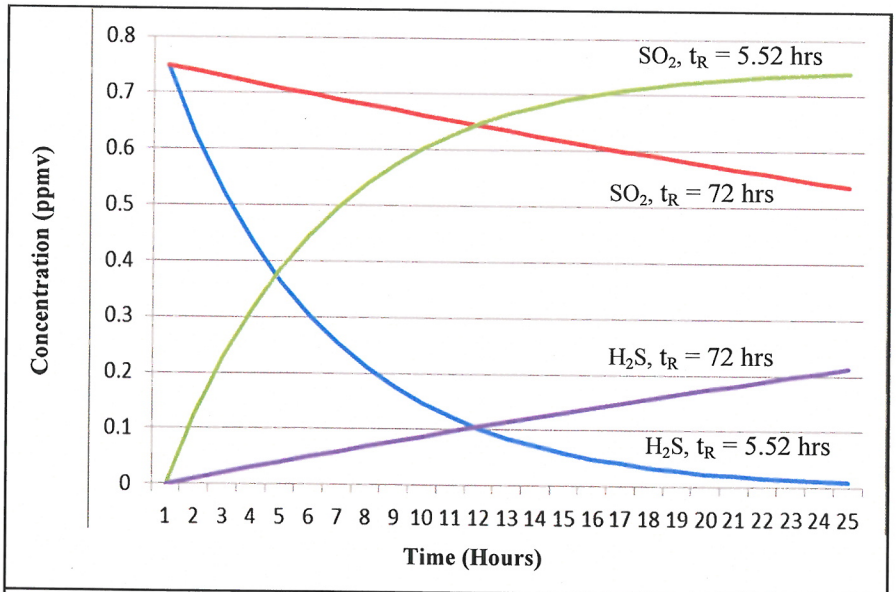

Figure 3. H_2S AND SO_2 CONCENTRATIONS OVER TIME (PRESUMING NO AIR INFLOW OR DISPERSION)

6. Dispersion of H_2S /SO_2 from the landfill surface.

As a result of temperature variation and winds, emissions of landfill gas and H_2S at the surface of the landfill cell will mix into the layer of air near the surface, which will result in diluting the concentrations in air compared to the levels measured at the surface. DEQ conservatively estimated the downwind concentrations of H_2S and SO_2 from fugitive landfill gas emissions based on the following:

- The maximum distance (L) across the uncapped, active portion of the Hidden Hollow Landfill cell is about 720 meters.

- Ninety-six percent of average hourly winds ($\bar{u}$) were greater than 1 m/sec in the meteorological data collected at the Boise airport from 2005 through 2009.

- No credit was taken for dilution associated with mixing in the ambient air or from inflow of "clean" air as the plume travels. Reductions in the concentration of H_2S in the air are due only to the conversion of H_2S to SO_2.

- For a box of unit width and length L, the time needed to "flush" the air out of the box depends on the wind speed, $\bar{u}$: tFlush = $L/\bar{u}$ = 720 m /(1 m/sec) = 720 sec = 12 min.

This simple but very conservative approach is shown graphically in Figure 4.

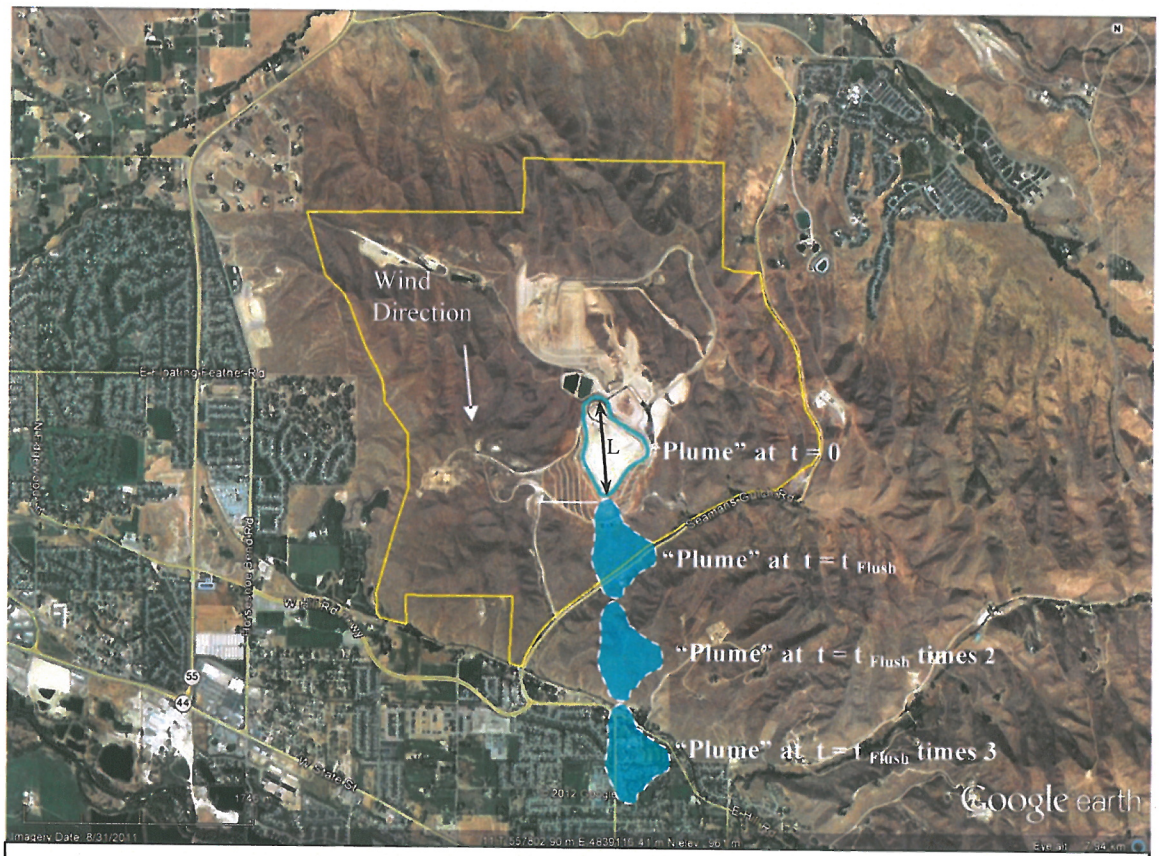

Figure 4. EXAMPLE OF "PLUME" FLUSHING OVER TIME

- Mixing heights (h) during nighttime hours are typically an order of magnitude less than the maximum daytime value.[12] Mixing heights during daytime hours are typically tens to hundreds of meters, due to convective heating during the day. The mixing height for nighttime dispersion was set to one tenth (5 meters) of the minimum 50-meter mixing height specified in the EPA-approved CALPUFF dispersion model.[13] The mixing height for daytime dispersion was set to 50 meters.

[12] Lakes Environmental, Met Monitoring Guide, Section 6.6, Boundary Layer Parameters, accessible at www.webmet.com/met_monitoring/66.html

[13] Scire 2000. A User's Guide for the CALPUFF Dispersion Model (Version 5), Joseph Scire et al, Earth Tech, Inc., January 2000, http://www.src.com/calpuff/download/CALPUFF_UsersGuide.pdf

- The equilibrium concentration of H_2S above the uncapped landfill surface during nighttime hours (when dispersion is typically reduced, leading to higher ambient concentrations) can then be calculated as follows:

$$C_e = \frac{L\,Q_a}{h\,\bar{u}} = \frac{720\text{ m}}{5\text{ m}} \times \frac{56.7 \times 10^6\ \mu\text{g}}{\text{min}} \times \frac{1}{64\text{ acres}} \times \frac{1\text{ acre}}{4046.873\text{ m}^2} \times \frac{\text{sec}}{1\text{ m}} \times \frac{\text{min}}{60\text{ sec}} = \mathbf{525\ \mu g/m^3}$$

ppmv = $\mu g/m^3/(40.833 \times MW)$ = 525 $\mu g/m^3$ /(40.833 x 34.08 g H_2S/ mol) = **0.38 ppmv H_2S**

- The equilibrium concentration of H_2S above the uncapped landfill surface during daytime hours, using a conservative (when , leading to higher ambient concentrations) can then be calculated as follows:

$$C_e = \frac{L\,Q_a}{h\,\bar{u}} = \frac{720\text{ m}}{50\text{ m}} \times \frac{56.7 \times 10^6\ \mu\text{g}}{\text{min}} \times \frac{1}{64\text{ acres}} \times \frac{1\text{ acre}}{4046.873\text{ m}^2} \times \frac{\text{sec}}{1\text{ m}} \times \frac{\text{min}}{60\text{ sec}} = \mathbf{53\ \mu g/m^3}$$

ppmv = $\mu g/m^3/(40.833 \times MW)$ = 53 $\mu g/m^3$ /(40.833 x 34.08 g H_2S/ mol) = **0.038 ppmv H_2S**

Estimates of SO_2 concentrations in air for a maximum "plume" length of 720 meters and wind speed of 1 meter per second (2.24 mph) are shown in Table 3 for H_2S retention times t_R of 0.23 days (5.52 hours), assuming daytime conditions and 3 days (72 hours) assuming nighttime conditions. It would be highly unlikely to have no air flow across the landfill cell for more than an hour, but as a worst case, presume no air flow for six flushing times (1.20 hours) for both daytime and nighttime conditions. As shown in the table, the contribution to the SO_2 background from fugitive H_2S emissions from the uncapped area of the Hidden Hollow Landfill cell, combined with the first-high monitored value collected at the St Luke's Meridian site, does not exceed the background value of 33.1 $\mu g/m^3$ presumed for the Ada County Landfill flare modeling.

Table 3. CONVERSION OF H_2S TO SO_2 OVER UNCAPPED AREA

		Daytime C_e = 0.038 ppmv			Nighttime C_e = 0.38 ppmv		
		t_R =	5.52	hours	t_R =	72	hours
		k =	0.1812	hr^{-1}	k =	0.0139	hr^{-1}
# Flushing Times	**Time (hrs)**	**H_2S $C = C_e e^{-kt}$ (ppmv)**	**SO_2 (ppmv)**	**SO_2 ($\mu g/m^3$)**	**H_2S $C = C_e e^{-kt}$ (ppmv)**	**SO_2 (ppmv)**	**SO_2 ($\mu g/m^3$)**
1	0.20	0.037	0.001	3.53	0.379	0.0011	2.8
2	0.40	0.035	0.003	6.94	0.378	0.0021	5.5
3	0.60	0.034	0.004	10.23	0.377	0.0032	8.2
4	0.80	0.033	0.005	13.40	0.376	0.0042	11.0
5	1.00	0.032	0.006	16.45	0.375	0.0052	13.7
6	1.20	0.031	0.007	**19.40**	0.374	0.0063	**16.4**
1st High, St Luke's		---	---	12	---	---	12
Total "Background"		---	---	**31.4**	---	---	**30.1**

Appendix

Public Comments Submitted for

Tier I Operating Permit

T1-2011.0128

And

Permit to Construct

P-2009.0001

Comments Received via DEQ's Website February 13, 2012

Comment 1: **Alisa Bondurant:** "I am concerned that the increase in hydrogen sulfide will create horrific smells beyond what we currently endure near the dump. Also hydrogen sulfide is considered a broad-spectrum poison. The toxicity of H_2S is comparable with that of hydrogen cyanide. I am concerned that not enough research has been done at the 600 Ppmv level."

Comment 2: **Brian Alan:** "I can think a of a lot of better ways to spend stimulus funds than to create a project that isn't necessary and doesn't improve anyone's standard of living. Additionally, I can't imagine that an industrial smoke stack and smoke coming up won't damage the surrounding property values. Whether there is a real or perceived environmental impact won't matter when perception devalues the property and changes the Boise ridge line. An easy way for the companies to get richer and the surrounding neighborhoods to suffer. Not in favor, not a fan and a religious voter."

Comment 3: **Gary Smith:** "Given the dramatic upswing in smells from the landfill settling into the Seaman's Gulch corridor, I think this should be handled very cautiously.

Comment 4: **Richard Llewellyn:** "As a neighbor of the Hidden Hollow landfill, I am concerned with any project that may add to the trend of increasing landfill odors. Specific to this project, I am concerned with the more than 10x increase in potential hydrogen sulfide emissions.

Could you summarize the need for this large increase? The Public Notice references the Statement of Basis regarding the increase in this emission, and the Statement of Basis references Appendix B AMBIENT AIR QUALITY IMPACT ANALYSES (p.32 of the pdf on your website), which is blank."

Comment 5: **Karen Danley:** "I strongly support a public hearing concerning the hydrogen sulfide permit for the landfill. My family already smells the dump gasses 80% of the time. We have been told by the director, Ted Hutchinson and Commissioner, Sharon Ullman the intoxicating odor will be addressed. I am gravely concerned about the quality of life in my neighborhood as well as the quality of health.

The dump gasses have increased 100 fold the last year. I not only smell it at my house but also on trails both west and east of the landfill, Gary Lane, Horseshow Bend Road, Seaman's Gulch, and I have reports of the odor at Shadow Hills Elementary School.

Hydrogen sulfide is a poisenous gas. The gas odor is already overwhelming. There is no reason to allow for more hydrogen sulfide and put residents and school children at risk. Again, I request a public hearing and cHertainly a solution to this quality of life and health issue as soon as possible."

Comments Received via DEQ's Website February 17, 2012

Comment 6: **Karen Danley:** "Tonight my home smelled at level one however when my eight year old daughter and I were on the Veteran's trail when it began to smell severely as we ascended up the hill. It was so bad we turned around and went back down the trail. Due to the winds, the smell was actually better at lower elevations It was a pungent sweet smell. There was a wind coming from the North and slightly East, directly from the dump. I know friends of mine also smell the dump from the Eagle Hills subdivision. I know they are eager to have the odor issue resolved as well.

The smell is also prevalent at Hidden Springs in the morning. Actually, when I don't smell it here as strongly it is stronger there. It is most likely due to the winds. I work at Hidden Springs every weekday morning so I am aware of the correlations.

I have smelled the odor every day at my home for the past week ranging from 1-5. The odor in the trail today was the worst this week. I have been sending a log to Ted since last Friday as per his request. I know there have been other neighbors in my area who have done the same last fall."

I look forward getting the air tested at my house and other places along the boundaries. Thank you Ted, Sharon, and Cheryl for your willingness to look into a device to test hydrogen sulfide as discussed. I am sure with such a team effort the testing will occur.

Perhaps it would be wise to include in the new permit an addendum addressing the odor management.

I look forward to working together to address the health and odor issues so my neighborhood is enjoyable once again to live in. Thank you for your attention to this very important matter of clean air."

Comments Received via DEQ's Website February 18, 2012

Comment 7: **Greg Olson:** "Everyone, I wanted to add my concern about the periodic and lately more regular smells of rotten flesh/sweet stinky odors that cover the area for hours or entire days during calm weather. It concerns me greatly that the land fill is requesting an increase in there gas emissions allowable. As I have learned recently the levels already allowed can be toxic as per information provided by http://el.erdc.usace.army.mil/workshops/04jun-wots/kaluschue.pdf. The new higher level proposed is disturbing for multiple reasons:
1. Most large businesses of late show a high degree of trying to get away with things right up until it is so bad they cannot hide it any more or someone dies/gets foreclosed on. From the number of times I have experienced STRONG smells and headaches afterword it explains a lot to see this."

Comment 7: **Greg Olson (continued):** "2. This gas is something that can be harnessed for generating power. Whatever is slowing that process down and stopping the land fill from ramping up there harvest of this gas and burning it into a less harmful format needs to be fixed ASAP. Harvesting all the gas is a fine way to mitigate the problem."

Comment 7: **Greg Olson (continued):**"3. From what I have read on the toxicity of this gas I am not willing to allow myself or my family to be the canary here. I want tests for our water and air now. I want the land fill to pay for it. I want a contact from a neutral party to handle the process.

I look forward to speaking with any of you who share my concerns and find a speedy and hopefully also mutually beneficial solution. The land fill serves a necessary purpose, that purpose IS NOT so great or so limited to this specific location to warrant sacrificing anyone's health or life!"

Comments Received via DEQ's Website February 19, 2012

Comment 8: **Greg Olson:** "I am a resident living on hill road near the land fill and feel that it is necessary to add my concern about the periodic and lately more regular smells of rotten flesh/sweet stinky odors that cover the area for hours or entire days during calm weather. It concerns me greatly that the land fill is requesting an increase in there gas emissions allowable. As I have learned recently the levels already allowed can be toxic as per information provided by http://el.erdc.usace.army.mil/workshops/04jun-wots/kaluschue.pdf. The new higher level

proposed is disturbing for multiple reasons:
1. Most large businesses of late show a high degree of trying to get away with things right up until it is so bad they cannot hide it any more or someone dies/gets foreclosed on. From the number of times I have experienced STRONG smells and headaches afterword it explains a lot to see this.
2. This gas is something that can be harnessed for generating power. Whatever is slowing that process down and stopping the land fill from ramping up there harvest of this gas and burning it into a less harmful format needs to be fixed ASAP. Harvesting all the gas is a fine way to mitigate the problem.
3. From what I have read on the toxicity of this gas, I am not willing to allow myself or my family to be the canary here. I want tests for our water and air now. I want the land fill or responsible entity to pay for it. I want a contact from a neutral party to handle the process.

I look forward to speaking with any of you who share my concerns and find a speedy and hopefully also mutually beneficial solution. The land fill serves a necessary purpose, that purpose IS NOT so great or so limited to this specific location to warrant sacrificing anyone's health or life!"

Comments Received via DEQ's Website February 27, 2012

Comment 9: **Karen Danley:** "1. Please read the last letter in the attached PDF. It is written by Delores (Dee) Conner in 2000. The letter still holds true as it did 12 years ago. I could have written this letter today.

It truly is time the excessive odor issue is properly addressed particularly before a permit to allow more admissions is granted.

For your information, Delores passed away last year.
http://aldenwaggoner.blogspot.com/2011/06/dee-conner.html?m=1

2. I truly hope that the onetime odor test recorded as a response to my complaint is not considered adequate. The odors come and go effecting 80% of the days. You can't drive by a few times and claim there is no odor issue."

Comments Received via DEQ's Website March 5, 2012

Comment 10: **Shaun Greer:** "Thank you for the quick response and information. I would like to request some additional data as follows:

1) Landfill gas-collection well header pressure Pre-landfill gas engine installation/operation (monthly/weekly average pressure data would be sufficient)
2) Landfill gas-collection well header pressure Post-landfill gas engine installation/operation (monthly/weekly average data would be sufficient)

My Concerns:
- I am concerned the county is operating the well gas extraction system to benefit the voluntary landfill gas-to-energy project owned by G2 Energy LLC rather than for the benefit of Ada County Citizens."

Comment 10: **Shaun Greer (continued):** - "Can you please tell me if the County is choosing to set the negative gas pressure in the gas-extraction well system to suit the gas-to-energy system or choosing to set the maximum negative pressure possible without causing excess CO2 and causing landfill combustion concerns?"

Comment 10: **Shaun Greer (continued):** - "I have additional concerns with the County spending $1.3M on a hydrogen sulfide removal system that will not reduce landfill gas odors. The smells we are having to live with on a daily basis are not from Hydrogen Sulfide (H2S). Is the County spending more than $1.3M on an H2S removal system to suit the gas-to-energy project? If so this will only lock the county into my suspicions that the gas-extraction system is being operated to benefit the voluntary gas-to-energy project rather than for the benefit of the County Citizens. It is my understanding the gas extraction wells were installed at the landfill to comply with regulatory requirements of landfills requiring to mange landfill gases/odors.

Thank you for your time and understanding of my/and others concerns. Please note I would not be spending time/effort on this if there was truly not an issue. My family and I are living with the nuisance odors on a daily basis and it is becoming unbearable and decreasing property value. I hope to be able to provide assistance/direction to a solution that will benefit Ada County, myself and others affected by the issue.

Please let me know if you can supply me with the data requested and answers to my questions. Feel free to call me if you would like to discuss in more detail."

Comments Received via DEQ's Website April 3, 2012

Comment 11: **Karen Danley:** "I will oppose raising the permit to 600 ppm unless the at the very least the following requirements are agreed to.
1. H2S treatment system such as scrubbers"

Comment 11: **Karen Danley (continued):** 2. "Odor Addendum"

Comment 11: **Karen Danley (continued):** 3. "Closing the Hidden Hollow Landfill and begin using exclusively the new landfill which is lined and meets current landfill requirements."

Comment 11: **Karen Danley (continued):** 4. "Lowering the hydrogen sulfide and SO_2 permit considerably. With the hydrogen scrubber at the farthest upstream point to be most effective there should not be a need to be emitting such high amounts of H_2S and/or sulfer dioxide."

Comment 11: **Karen Danley (continued):** "I do realize the DEQ model may indicate you are under EPA standards by the however this does not deal with the odor issue plus the model is an estimate which at its best can be somewhat correct. You must know the exact concentrations at check points at the boundaries AND the surrounding low lying areas where the H2S will sink to."

Comments Received via DEQ's Website April 9, 2012

Comment 12: **Richard Llewellyn:** "A. Modeling of background and emitted hydrogen sulfide and sulfur dioxide

Our primary concerns with the draft permit per se are the assumptions and modeling techniques used to derive background levels of sulfur dioxide (SO_2). These concerns regard the level of background SO_2 upon which any new emissions are assumed additive. First, the background levels (Statement of Basis, Appendix B, references Hardy, Rick, Schilling and Kevin. Background Concentrations for Use in New Source Dispersion Modeling. Memorandum to Mary Anderson, March 14, 2003) do not appear to make reference to a known local emitter of hydrogen sulfide (H_2S), the landfill itself. H_2S is rapidly converted to SO_2 (reference page 225 Environmental Science and Technology: A Sustainable Approach to Green Science and Technology, Stanley E. Manahan, CRC Press 2007) and therefore the fugitive $H2_S$ emissions from the landfill must enter the background calculation. This is not a technical detail: fugitive

gases may well comprise a quarter to fifty percent of total emissions from an unlined open cell with a gas collection system in place:

"Reported collection efficiencies typically range from 50 to 95%, with a default efficiency of 75% recommended by EPA for inventory purposes. The lower collection efficiencies are experienced at landfills with a large number of open cells, no liners, shallow soil covers, poor collection system and cap maintenance programs and/or a large number of cells without gas collection. The higher collection efficiencies may be achieved at closed sites employing good liners, extensive geomembrane-clay composite caps in conjunction with well engineered gas collection systems, and aggressive operation and maintenance of the cap and collection system." (reference United States Environmental Protection Agency's AP 42, Fifth Edition, Volume I Chapter 2.4: Solid Waste Disposal, Municipal Solid Waste Landfills, Draft Section 2008.)

If and where the emissions do enter the background calculation, they should not rely on the previously modeled 35 ppm H2S in landfill gases but should reflect the twenty-fold increase when measured: e.g. 750 ppm taken last summer from the collected stream.

Second, the level of geographic, and especially topographic, detail used for both background and emitted emissions do not adequately reflect the highly varied terrain of the foothills between the landfill and Hill Road. The 30 m resolution used as input for terrain modeling (Statement of Basis, Appendix B, p.7) cannot adequately capture the complex terrain features in this area. These lower foothills are characterized by steep (40 degree) slopes and narrow gullies that form local collectors of landfill odors, and by reasonable extension, landfill gases. It is likely that some locations along Hill Rd between Dry Creek Cemetery and Pierce Park Lane receive much higher levels of emissions than others: this is observable by traveling along canal especially in the evening. Odors, and by extension landfill emissions that include H2S, concentrate locally at the mouths of gullies and flow into local depressions that could not be captured by a 30 m resolution. Furthermore, trees (tree lined canal, roads, and shade trees near houses) can divert the modeled flow of atmospheric pollutants. We have noticed that landfill odors are often concentrated at the bases of large trees. Atmospheric particulate matter may collect at the bases of trees "In contrast, tree canopies may reduce dispersion, causing locally elevated PM concentrations" (reference Coupling biogeochemical cycles in urban environments: ecosystem services, green solutions, and misconceptions. Diane E Pataki et. al. Front Ecol Environ 2011).

The receptor grids used for modeling are too wide to capture the potential of local concentrations of background and emitted pollutants. For Hidden Hollow Energy (HHE), the grids are spaced at 100 m at distances over 1 km from the generators, and 100 m for Ada County Landfill at distances over 2km from the flares (Statement of Basis, Appendix B, page 6). Although captions are missing from figures on modeling review, page 10, these appear to designate receptors of significant impact. The resolution is poor in these figures, but they appear to reflect little, if any, of the contribution of the local topographical features: e.g. North to South running gullies opening to Farmers Union Canal and Hill Rd that collect and concentrate odors. Some of these gullies are scarcely 100 m from crest to crest, but may more than a hundred feet deep. The figures based on modeling do not reflect observations made by local residents, in which landfill odors may remain in one area for many hours at the mouths of gullies or the bases of trees or in local depressions while only passing intermittently through others. One should assume that landfill emissions would also follow these patterns, and therefore local residents may have highly variable exposures depending on these local features."

"B. Reliance on modeling rather than measuring fugitive emissions

Due to difficulty modeling as represented by the 20 fold underestimation of H2S, the landfill should measure emissions at various points in nearby neighborhoods. It is reasonable to assume

that if H2S levels dramatically under-modeled, emissions of more toxic substances may also be under represented. At the very least, H2S and methane should be measured at points along Hill Rd, Bogart Lane, Hill Rd Parkway, and Gary Lane."

"C. Odors

Odors have increased in the last year (we noticed such strong odors June of 2011 that we contacted the landfill), and have become a considerable nuisance that limits enjoyment of our property, regardless of any health effects the components responsible for the odors may have. H2S and/or SO2, or other sulfur containing compounds such as mercaptins may be part of the odor problem. Odor mitigation should take precedence over energy generation if conflicts between these exist: e.g. the vacuum placed on the wells should not be reduced to provide feed with limited oxygen to generators rather than landfill flares. Due to the difficulties in monitoring odor over a large area encompassing parts of Eagle, Boise, Hidden Springs, and unincorporated Ada County, we recommend that a more robust public odor reporting protocol be established as part of the permit to emit more H2S. We recommend that this system be transparent: the public should be able to easily view reports and any activity taken to mitigate the reported odors. A well designed system that collects reports with geographic location and current meteorological data, with description of the odor type and intensity, could be invaluable as a landfill management tool. Current web technology combined with rapid and mobile data transfer technologies such as Twitter would make development of a real time odor report system very feasible. In addition, part of the impact of odors on nearby neighborhoods is the limited feedback and communication from the landfill regarding odors and mitigating activities. A transparent web-based system would provide those affected a public forum for their concerns. In addition, it would provide the landfill managers a site to warn the public of activities that might temporarily increase odors, for example, the digging of new gas collection wells, and thus could improve trust and communication between these parties.
Other landfills have surveyed their neighbors regarding odors (reference Managing Odour Risk at Landfill Sites: Main Report. P McKendry, J H Looney, A McKenzie. MSE Ltd & Viridis, 2002.) This would be, at the very least, a starting point, though would be less useful than a dynamic system as a management tool to link practices to odors. Note also that it should not be assumed that only fugitive gases are responsible for the odors: flare combusted gases may also contribute to the problem (reference McKendry page 50)."

Comment 13: **Shaun Greer:** "I believe an Odor Control Plan should be implemented as part of the permit renewal and that no increase in the limit of H_2S should be allowed. Ada County is asking for the ability to increase air pollutants and they currently cannot manage or control the air pollutants they are currently emitting. In the last year there have been approximately 41complaints of nuisance odors from the Ada County Landfill. The Landfill has done nothing to educate the public on operational changes they have done at their facility to address these complaints, if they have done anything to address them in the first place. A robust Odor Control Plan should be implemented that would require Ada County to measure actual air pollutants (odor and non-odorous) at property boundaries. If air pollutants are not within the permit guidelines the facility should be required to pay fines in the amount that will incentivize them to make operational changes and not just keep operating as usual."

Comment 14: **Shaun Greer:** "Ada County should implement an easy way for the general public to notify the facility of landfill odors. There is currently no stated process for issuing odor notifications/complaints. The data would be valuable to landfill operators which they could use to help with operations of the facility. The Ada County website should describe the process that the general public can take to notify the facility of odors and formally file an odor complaint. An Idea would be to allow odor complaints to be submitted on-line. Using one form for the complaints would allow the data to be consistent and much more usable for facility operations.

The current odor notification/complaint process is ambiguous to say the least and there is no follow-up process."

Comment 15: **Shaun Greer:** "Ada County Does Not Operate The Gas Extraction System For the Benefit of Controlling Landfill Gas:

Ada County has a gas extraction system at their facility that is meant to control Landfill Odors. The gas flares connected to the system are designed to operate at 5-percent oxygen content. Meaning the Lanfill can increase the negative pressure on the landfill to a point where they capture 5-percent oxygen in the landfill gas.

The Fortistar CAT engine generators will only operate at a maximum of 2-pecent oxygen content in the landfill gas. For this reason Ada County reduces the negative suction on the landfill for the benefit of Fortistars operations rather than the reason the gas extraction system was installed in the first place, "to control landfill gas". I believe Ada County should be required to operate the gas extraction system for the benefit of meeting their permit requirements, reducing fugitive odorous landfill gas, and for the benefit of the general public…not for CAT engine generators that are not even owned by Ada County."

Comment 16: **Shaun Greer:** The percent capture rate of the landfill gas should be adjusted to reflect real world conditions. The gas not collected in the gas extraction system should be considered fugitive gas and be added to the ambient air conditions in the permit calculations. The landfill gas capture rate of 85% is used for the calculations in the permit. If this value is based on typical operations of other landfill gas systems with typical gas extraction systems, then it is too high of a capture percentage. The Ada County gas extraction system was designed to capture gas that would allow a 5-percent oxygen content, this is how typical landfill gas extraction systems function/operate. The Ada County system is only operating at approximately 2-percent oxygen content, meaning it is operating at less than half capacity or capture rate of what typical landfill gas extraction systems do. The capture rate for the Ada County permit needs to be lower that typical landfills with gas extraction system because it is not being operated as a typical gas extraction system at a landfill or how it was designed to operate.

Comment 17: **Karen Danley:** "I oppose the permit unless the following goals are met.

GOALS
Odor Control Addendum: I strongly believe the new operating permit should require a robust and transparent odor monitoring and resolution protocol that includes a means for collecting public odor alerts and analyzing the effect of management practices on noticed odors. In addition, the odorous gases that escape at the landfill borders should be sampled and measured to create a baseline for future reference."

Comment 17: **Karen Danley (continued):** "Expedite the Installation of an Effective Hydrogen Sulfide Removal System: We have received a letter from the Landfill Director, Ted Hutchinson, on March 2, 2012 committing to the installation of a hydrogen sulfide removal system. The next goal is an installation timeline. There is not a need to increase the hydrogen sulfide permit with the Hydrogen Sulfide Removal System in operation."

Comment 17: **Karen Danley (continued):** "Expedite Closure of the Hidden Hollow Cell Near Boise: This portion of the landfill was originally scheduled to close in 2010. As the mound of garbage has grown out of the original ravine to form the highest ridge in the area, odors have become increasingly difficult to control since it is no longer hidden nor hollow."

Comment 18: **David Kapral:** "I wish to state that I am vigorously opposed to raising the permissible level of H2S omissions to 600ppm at the ADA county landfill!

in a letter to its neighbors to install a hydrogen sulfide removal system, which is beneficial for the air quality of everyone in the Treasure Valley. The permit at this current level of 600 parts per million is unnecessary now that the hydrogen sulfide will be removed. The third goal is to expedite the closure of the Hidden Hollow Cell, because it is no longer hidden and no longer hollow. It is one of the highest ridges in the area, which makes it difficult for anyone to manage odors. It was scheduled to close in 2010, and it is still open. It is time to move completely to the North Ravine Cell.

Comment 22: **Richard Llewellyn:** And most of my comments have been already submitted online, but I would like to add a comment about the 85 percent assumed efficiency of the landfill gas collection system. According to AP42 of the EPA, typically 75 percent is assumed to be collected by extraction system. Values range from 50 to 95 percent. If you have an open landfill cell, which is still currently collecting garbage, and if it's unlined, you should expect these numbers to be on the lower end of that range. Now that's important because the hydrogen sulfide that comes from that which is not collected, so 100 minus this number, this efficiency number, has to go somewhere. It's emitted as fugitive gases. If it's hydrogen sulfide, it's rapidly converted to sulfur dioxide in the atmosphere, and that contributes to what should be added to the background levels of total sulfur dioxide emitted by the landfill. I believe this will very clearly put the total contributions over 100 tons per year. So that assumption of 85 percent capture efficiency is important, and I believe it's high. And in general I think we should note that this same AP42, we heard today that that's where the 35 parts per million of hydrogen sulfide are assumed to be present in landfill gases, and it's been measured at more than 20 fold of that level. So again, I don't think we should be relying on these especially optimistic background modeling levels. So that's my comment. Thank you.

Comment 23: **Tina Smith:** I teach at Hidden Springs Elementary School, almost a stone's throw from this landfill. The smell has gotten worse on our school campus. We have a preschool that's just down the street from the elementary school. And last Thursday in particular when all the kids were out during their lunchtime, the smell was pretty horrific, and the kids were walking around like this (indicating), trying to figure out what's going on in their neighborhood. It's really gotten to a point where it's impacting the neighborhood as well as the school day. That's all I want to say.

Comment 24: **Greg Olson:** I haven't spoken yet. My name is Greg Olson, O-l-s-o-n. I have two concerns. One, I am also concerned that the raising of the present limit is based on numbers that are on models rather than actual fugitive gas tests. And I would like to see a little bit more comprehensive testing, real world testing. And it also concerns me that complaints that I have filed don't seem to be getting submitted to the right people when I hear in this meeting that the person that's supposed to be getting these complaints has only gotten one complaint and I know that I have submitted at least one myself and that neighbors have also done that. And they seem to be disappearing or at least not being registered properly. That concerns me. And so I would recommend that this permit at the very least be put on hold until such issues like that are resolved.

Comment 25: **Sharon Konkol:** I'm a neighbor of the landfill, not a very close neighbor. I live near the intersection of Hill Road and Pierce Park. So that's quite a ways away. And yet I'm still smelling it on a pretty regular basis. When I saw fliers posted by Karen, I realize now that there's a way that I can submit just an e-mail to an e-mail list that indicates that I'm smelling it, so I will be using that list frequently. In addition to being a neighbor, I'm a foothills trail user. I use those trails every day. I run every day up there. And I smelled it today. And in the last two weeks I have probably smelled it I would say three to four times. In the past months, mostly back towards the December-January timeframe, I smelled it every day for two months. And it was awful. It was horrible. So much so that I decided to move my run to a different area of town. That's not right. I'm just asking the landfill to be a good neighbor. Thank you.

Comment 26: **Greg Danley:** I guess I'm concerned about the fugitive gases and why they haven't been -- why nobody's keeping track of them or measuring them or, you know, even monitoring where they might be flowing. I mean, I think all of us live below the landfill, and from my understanding this gas is heavier than air and will follow the natural contour of the land, which is downhill. And that's where we live. I'm glad you guys are concerned with how much, how efficient the flares are burning, burning these gases up, that gas that's being collected and measured. But nobody seems to know how much fugitive gas is being emitted from the landfill. And that should be taken into consideration.

Comment 27: **Karen Danley:** I would like to see the gas measured at the boundaries with a Jerome meter, not with someone's nose, but with a specific device that will detect very low concentrations of the gases so that there's actually a measured baseline that you have something to compare and something to alert you.