WESTERN PLACER
WASTE MANAGEMENT AUTHORITY

SUSAN ROHAN, ROSEVILLE, CHAIR
JACK DURAN, PLACER COUNTY
GEORGE MAGNUSON, ROCKLIN
PAUL JOINER, LINCOLN
ROBERT WEYGANDT, PLACER COUNTY
MARY DIETRICH, EXECUTIVE DIRECTOR

MEETING OF THE BOARD OF DIRECTORS

AGENDA

August 14, 2014 6:00 PM

Materials Recovery Facility Administration Building
3033 Fiddyment Road, Roseville, CA 95747

Materials related to an item on this Agenda submitted to the Board of Directors after distribution of the agenda packet are available for public inspection at the Clerk of the Board, 3033 Fiddyment Road, Roseville, CA 95747, during normal business hours and at the meeting location immediately before and during the meeting. The Western Placer Waste Management Authority is committed to ensuring that persons with disabilities are provided the resources to participate fully in its public meetings. If you are hearing impaired, we have listening devices available. If you require additional disability-related modifications or accommodations, including auxiliary aids or services, please contact the Clerk of the Board at (916) 543-3960. If requested, the agenda shall be provided in appropriate alternative formats to persons with disabilities. All requests must be in writing and must be received by the Clerk five business days prior to the scheduled meeting for which you are requesting accommodation. Requests received after such time will be accommodated if time permits.

1. Call Meeting to Order
2. Pledge of Allegiance (Director Joiner)
3. Roll Call
4. Statement of Meeting Procedures (Clerk of the Board)
5. Agenda Approval
6. Public Comment

   This is a time when persons may address the Board regarding items not on this Agenda. It is requested that comments be brief, since the Board is not permitted to take any action on items addressed under Public Comment.
7. Correspondence (Eric Oddo)

   Late-arriving correspondence (If any, distributed at meeting and noted by Chair.)
8. Consent Agenda

   a. Minutes of the Board Meeting held July 10, 2014 — Pg. 3

      Approve as submitted.

   b. Agreement to Conduct a Temporary HHW Collection Event in Auburn (Stephanie Ulmer) — Pg. 7

      Authorize the Chair to sign the Agreement with 21st Century Environmental Management to conduct a two-day Household Hazardous Waste and electronic waste collection event in Auburn

   c. First Amendment to the Lease Agreement with AMOS (Eric Oddo) — Pg. 21

      Authorize the Chair to sign the First Amendment to the Lease Agreement with the Associated Modelers of Sacramento that extends the term of their lease for an additional five years.

   d. First Amendment to the Second Restated and Amended MRF Operating Agreement with Nortech Waste LLC (Eric Oddo) — Pg. 29

      Authorize the Executive Director, upon review and approval by WPWMA Counsel, to sign the First Amendment to the Second Restated and Amended Operating Agreement with Nortech Waste

LLC for operation of the Materials Recovery Facility, which increases the monetary limit for extra services requested by the WPWMA.

9. Announcements & Information

a.	Reports from Directors	----
b.	Report from the Executive Director (Mary Dietrich)	----
c.	Monthly Financial Reports (Valerie Bayne)	----
d.	Monthly Tonnage Reports (Keith Schmidt)	----
e.	Quarterly MRF Operator's Report (Nortech Waste)	Pg. 35
f.	Quarterly Landfill Operator's Report (Nortech Landfill)	Pg. 39
g.	Quarterly WPWMA Engineer's Report (Keith Schmidt)	Pg. 41
h.	Creditable Recovery Achieved & Incentive Payments Earned by Nortech Waste in FY 2013/14 (Eric Oddo)	Pg. 45
i.	FY 2013/14 Recyclable Revenue Sharing (Eric Oddo)	Pg. 47
j.	CalRecycle HHW Grant Award (Stephanie Ulmer)	Pg. 49
k.	Continuous Odor Monitoring System Presentation (Eric Oddo)	Pg. 51

10. Action Items

a. Project 02466 – Module 5 Liner Construction and Module 15/16 Partial Final Cover (Keith Schmidt) — Pg. 55

1. Approve the plans and specifications and authorize staff to solicit bids for Project 02466 – Module 5 Liner Construction.
2. Authorize the Executive Director to execute the resulting contract with the lowest responsive bidder and approve any required change orders consistent with Section 20142 of the Public Contract Code in an amount not to exceed $6,776,000

b. Energy 2001 Contract Negotiations (Eric Oddo) — Pg. 57

Provide direction to staff regarding the ongoing contract negotiations with Energy 2001.

11. Upcoming Agenda Items

The Board may discuss issues of concern that they would like staff to address at future Board meetings.

12. Closed Session

Anticipated Litigation:

a. Initiation of litigation pursuant to subdivision (d)(4) of Government Code §54956.9: one potential case.

13. Adjournment

MEMORANDUM
WESTERN PLACER WASTE MANAGEMENT AUTHORITY

TO: **WPWMA BOARD OF DIRECTORS** DATE: **AUGUST 14, 2014**

FROM: MD **MARY DIETRICH / ERIC ODDO** EO

SUBJECT: **CONTINUOUS ODOR MONITORING SYSTEM PRESENTATION**

RECOMMENDED ACTION:

None. This report is for information purposes only.

BACKGROUND:

In mid-April of this year, installation, testing and calibration of the WPWMA's continuous odor monitoring system was completed enabling staff to objectively evaluate the probable impacts on surrounding communities of odors generated from the WPWMA's facility.

The monitoring system was designed to continuously measure specific odors and their intensities at four locations on the WPWMA's property. Data from seven additional on-site and four off-site odor sources considered to have relatively consistent odor emission profiles are also included in the model, though these sources are estimated rather than measured. These data are coupled with on-site weather station data to generate air dispersion models of the measured and estimated odors.

The resultant air (odor) dispersion modeling estimates are presented graphically over Google Earth satellite imagery, a sample of which is attached to this report. The model enables staff to quickly discern possible odor source(s) and their intensities as experienced by the public within a nearly 150 square mile area around the WPWMA's facility.

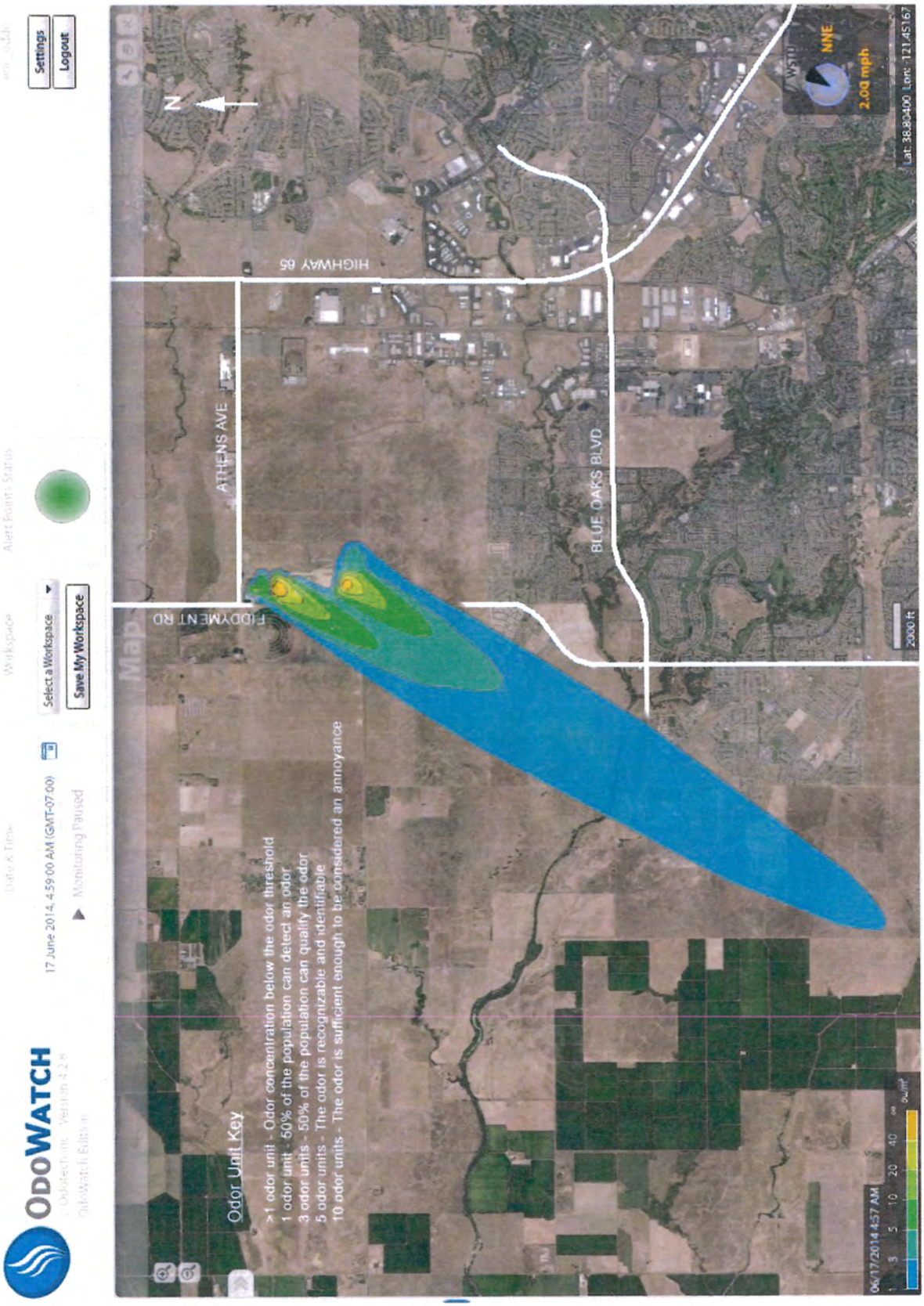
Staff has primarily used the system to investigate reported odors – a sample of an odor investigation report is attached for your Board's information. In the near future, staff intends to also use the system to better understand the combination of operational and meteorological conditions that may result in odor impacts to the community, and to evaluate the relative effectiveness of specific odor mitigation efforts such as odor neutralization agents.

Staff will make a detailed presentation of the system to your Board this evening.

MD:EO

ATTACHMENT: GRAPHICAL MODEL RESULTS SAMPLE
ODOR INVESTIGATION REPORT SAMPLE

GRAPHICAL MODEL RESULTS SAMPLE



ODOR INVESTIGATION REPORT SAMPLE

ODOR NOTIFICATION INFORMATION

Notification No. 493

This section presents a summary of the odor notification information received by the WPWMA via its on-line odor notification form.

Date and time notification was filed	6/18/2014 10:48 AM	Additional Comments
Date and time odor was experienced	6/17/2014 8:00 PM	CC" BONA
Length of time odor was experienced	30 minutes to 1 hour	
Odor description	Earthy/musty	
Odor intensity (between 1 and 5)	5	
Street	big bear	
Email address	Not provided	

WEATHER CONDITIONS

This section presents a summary of the weather conditions reported by the WPWMA's on-site weather station before, during and immediately after the time the odor was reported to have first been experienced.

Average Weather Conditions	Wind Speed (mph)	Wind Direction	Temp (F)	Atm Pressure (in Hg)	Precip. (in)	Humidty (%)
7:00 PM to 8:00 PM	6.12	NNW	82.3	29.71	0.00	20.4
8:00 PM to 9:00 PM	3.04	NW	79.6	29.71	0.00	20.2
9:00 PM to 10:00 PM	0.63	NNW	77.9	29.72	0.00	22.5

RESPONSE ACTIONS

This section provides a summary of the field invesigation (if any) of the reported odor performed by WPWMA personnel.

Performed on-site investigation at reported location ☐ Yes ☑ No If NO, why Notification received during non-working hours

On-site investigation performed by Time of on-site investigation

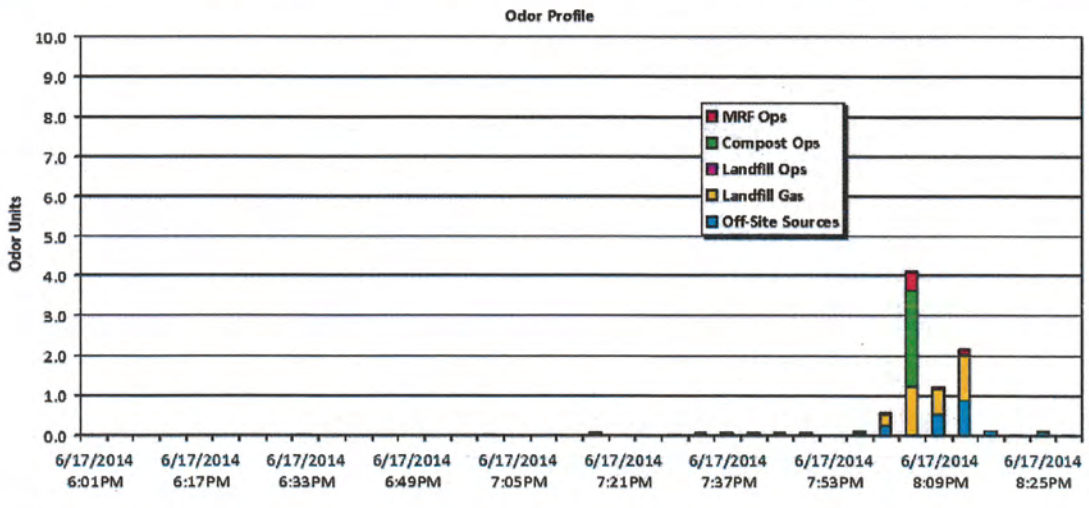
Detected odor at reported location ☐ Yes ☐ No ☑ N/A

Odor Description/Primary Odor Source Odor Intensity

RESULTS OF ODOR MODELING

Model Reference Location Leonard Davis Park

This section provides a summary of the predicted sources of odor and their estimated contribution to the potential odor profile at the reported location. These results are based on the WPWMA's continuous odor monitoring system and air dispersion modeling predictive software.



Odor Unit Key:
>1 odor unit - Odor concentration is below the odor threshold
1 odor unit - 50% of the population can detect an odor.
3 odor units - 50% of the population can quiffy the odor.
5 odor units - The odor is recognizable and identifiable
10 odor units - The odor is sufficient enough to be considered an annoyance.

WESTERN PLACER
WASTE MANAGEMENT AUTHORITY

JACK DURAN, PLACER COUNTY, CHAIR
GEORGE MAGNUSON, ROCKLIN
PAUL JOINER, LINCOLN
ROBERT WEYGANDT, PLACER COUNTY
SUSAN ROHAN, ROSEVILLE
MARY DIETRICH, EXECUTIVE DIRECTOR

MEETING OF THE BOARD OF DIRECTORS

AGENDA

March 12, 2015 6:00 PM

Materials Recovery Facility Administration Building
3033 Fiddyment Road, Roseville, CA 95747

Materials related to an item on this Agenda submitted to the Board of Directors after distribution of the agenda packet are available for public inspection at the Clerk of the Board, 3033 Fiddyment Road, Roseville, CA 95747, during normal business hours and at the meeting location immediately before and during the meeting. The Western Placer Waste Management Authority is committed to ensuring that persons with disabilities are provided the resources to participate fully in its public meetings. If you are hearing impaired, we have listening devices available. If you require additional disability-related modifications or accommodations, including auxiliary aids or services, please contact the Clerk of the Board at (916) 543-3960. If requested, the agenda shall be provided in appropriate alternative formats to persons with disabilities. All requests must be in writing and must be received by the Clerk five business days prior to the scheduled meeting for which you are requesting accommodation. Requests received after such time will be accommodated if time permits.

1. Call Meeting to Order
2. Pledge of Allegiance (Director Weygandt)
3. Roll Call
4. Statement of Meeting Procedures (Clerk of the Board)
5. Agenda Approval
6. Public Comment

   This is a time when persons may address the Board regarding items not on this Agenda. It is requested that comments be brief, since the Board is not permitted to take any action on items addressed under Public Comment.
7. Correspondence (Eric Oddo)

   Late-arriving correspondence (If any, distributed at meeting and noted by Chair.)
8. Consent Agenda

   a. Minutes of the Board Meeting held January 8, 2015 — Pg. 3

      Approve as submitted.

   b. Fourth Amendment to the Agreement for the Used Oil Public Awareness Program (Keith Schmidt) — Pg. 7

      Authorize the Chair to sign the Fourth Amendment to Agreement No. 45124 with Ross-Campbell, Inc. to conduct an oil recycling public education and outreach campaign for an amount not to exceed $67,180.
9. Announcements & Information

   a. Reports from Directors — ----

   b. Report from the Executive Director (Mary Dietrich) — ----

   c. Monthly Financial Reports (Valerie Bayne) — Pg. 13

   d Monthly Tonnage Reports (Keith Schmidt) — ----

   e. Quarterly MRF Operator's Report (Nortech Waste) — Pg. 17

f. Quarterly Landfill Operator's Report (Nortech Landfill) Pg. 21

g. Quarterly WPWMA Engineer's Report (Keith Schmidt) Pg. 23

h. Placer Ranch Notice of Preparation Comment Letter (Mary Dietrich) Pg. 27

i. Odor Update (Eric Oddo) Pg. 57

10. Action Items

a. Agreement to Design, and Provide Permitting and CQA Services for an Upgrade to the Landfill Gas Collection and Control System (Keith Schmidt) Pg. 71

1. Direct staff to negotiate an Agreement with Golder Associates, Inc. for design, permitting, and Construction Quality Assurance services during construction for the upgrade to the landfill gas blower/fare station and gas collection and control system, for an amount not to exceed $408,134.
2. Authorize the Chair to sign the resultant Agreement after review and approval by WPWMA Counsel.

11. Upcoming Agenda Items

Identification of any items the Board would like staff to address at a future meeting.

12. Closed Session

Anticipated Litigation:

a. Initiation of litigation pursuant to subdivision (d)(4) of Government Code §54956.9: one potential case.

13. Adjournment

MEMORANDUM
WESTERN PLACER WASTE MANAGEMENT AUTHORITY

TO: **WPWMA BOARD OF DIRECTORS** DATE: **MARCH 12, 2015**

FROM: **MARY DIETRICH / ERIC ODDO**

SUBJECT: **ODOR UPDATE**

RECOMMENDED ACTION:

None. This item is for informational purposes only.

BACKGROUND:

In January 2012 the WPWMA implemented a notification system on its website to make it easier for the public to report to the WPWMA when they experienced odors in the region. Since inception of the on-line notification system, staff has received an average of approximately 15 odor notifications per month.

Beginning in late January and extending into early February, the WPWMA received over 200 notifications regarding odors in the area. Odors were generally reported from the areas south of the WPWMA's facility as well as from the Rocklin area east of Highway 65[1]. The attached map identifies the locations of the odor notifications received in January and February; the attached chart identifies on which days the odor notifications were received. In addition to the increased volume of notifications, KCRA and KXTL news outlets interviewed staff and ran stories about odors in the area on January 26th and 27th, respectively.

Using the WPWMA's continuous odor monitoring system, staff was able to investigate most notifications and make an estimate of the likely source(s) of odors and the relative contribution and intensity of each odor source at the reported locations[2]. Of the 232 notifications received in January and February, data from the WPWMA's odor monitoring system suggests that approximately 7% were primarily related to odors from the WPWMA operations, 23% were a combination of WPWMA and other off-site sources and the remaining 70% were primarily related to off-site, non-WPWMA sources. As part of the WPWMA's investigation of each odor notification, staff provided a summary report of the investigation (via email) to the Placer County Air Pollution Control District and to the individual who filed the notification.

Based on the descriptors of the odors provided by the individuals using the WPWMA's notification system, field investigations by staff and the modeling results from the WPWMA's continuous odor monitoring system, staff were unable to definitively conclude the primary source of the reported odors or the key factors that lead to the apparent increase in odors in the cases where the WPWMA was not believed to be the

[1] Odors were also reported from a location in Auburn, Loomis, at the Sierra College and I-80 intersection and from southeast Roseville on the border with Citrus Heights. Given the distances between these locations and the WPWMA's facility and the weather conditions at the time of the reports, staff believes it is extremely unlikely these odors were related to the WPWMA's operations.

[2] The WPWMA's continuous odor monitoring system experienced a malfunction and went off line on January 23rd. As a result, the system did not record any data for the period of January 23 – 27. Staff utilized other meteorological station data and reviewed available operating data for this period to estimate likely odor sources.

primary source. Staff however believes that the odors experienced during this time frame were from a combination of industrial and agricultural sources in the area – many of which are not quantified in the WPWMA's continuous odor monitoring system. Furthermore, weather conditions during this period were generally cool in the mornings and evenings (when most odors were reported) and often during foggy and/or calm wind conditions. These weather conditions could have served to trap odors near ground level for extended periods of time.

Although the data suggests that a majority of the odors experienced by residents during January and February were not directly related to the WPWMA's operations, staff continue to pursue measures to reduce the frequency and intensity of odors from the WPWMA's facility that may be experienced by local residents. These measures include:

- Installation of a geomembrane cover on the southern slopes of Modules 15 and 16 of the landfill. This partial final closure project (approved by your Board at the August 14, 2014 meeting as part of the Module 5 base liner project) is anticipated to allow the WPWMA to pull more aggressively on the landfill gas collection system in this area thereby reducing the potential for surface emissions (and therefore odors) related to landfill gas. The cover project is anticipated to be completed by early summer of this year.
- Installation of a misting system at the MRF that will apply an odor neutralizer to all residual wastes leaving the MRF prior to burial at the landfill. Staff reported its intent to authorize Nortech to perform this work at the December 11, 2014 meeting and staff anticipates that the system will be installed and operational later this spring.
- Nortech has initiated a pilot study to perform in-vessel, aerated static pile composting of food wastes recovered from the MRF. Since the materials will be composted within an enclosed vessel, it is believed that the odor potential from this operation will be negligible. Additionally, removing highly odiferous, organic materials from the materials sent to the landfill for burial should reduce the odors generated at the landfill.

Additionally, staff are working with Odotech (the manufacturer of the WPWMA's continuous odor monitoring system) to upgrade the monitoring and modeling systems to improve the system's sensitivity and accuracy under low wind and/or stagnant air conditions. Staff has noted that a majority of the odor notifications it receives occur when there is little to no wind.

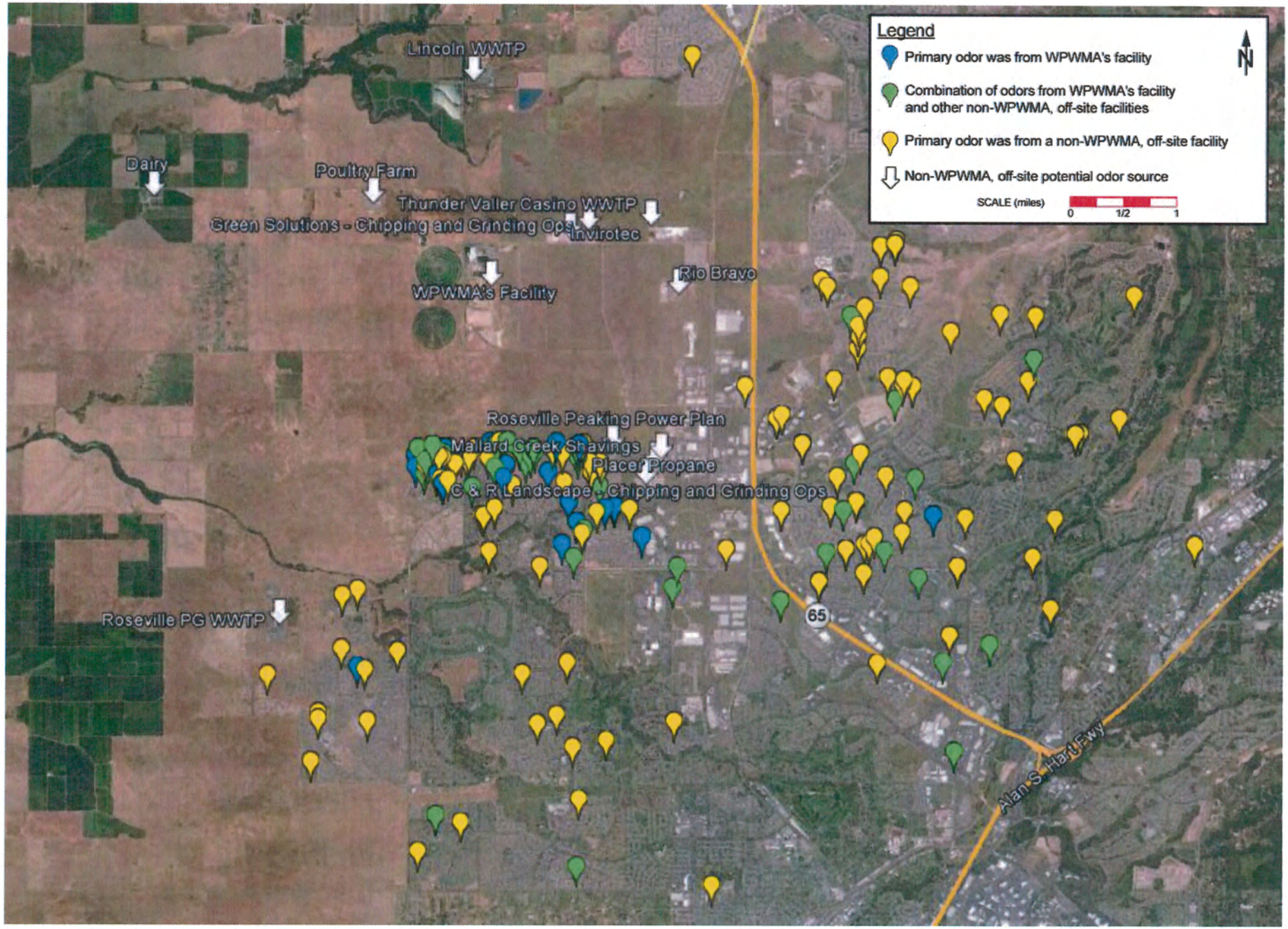
Of the 232 notifications that were received, five individuals questioned whether the odors they experienced pose a health risk. In response to these inquiries, staff provided documents found on-line that suggest that odors from composting operations and landfill gas (likely the main odors from the WPWMA's operations that one would experience off site) generally do not pose any long-term health risks. Copies of these documents are attached for your Board's information. However, as these documents are general in nature, the WPWMA may want to consider conducting a site-specific health risk assessment of the odors generated at the WPWMA's facility to more

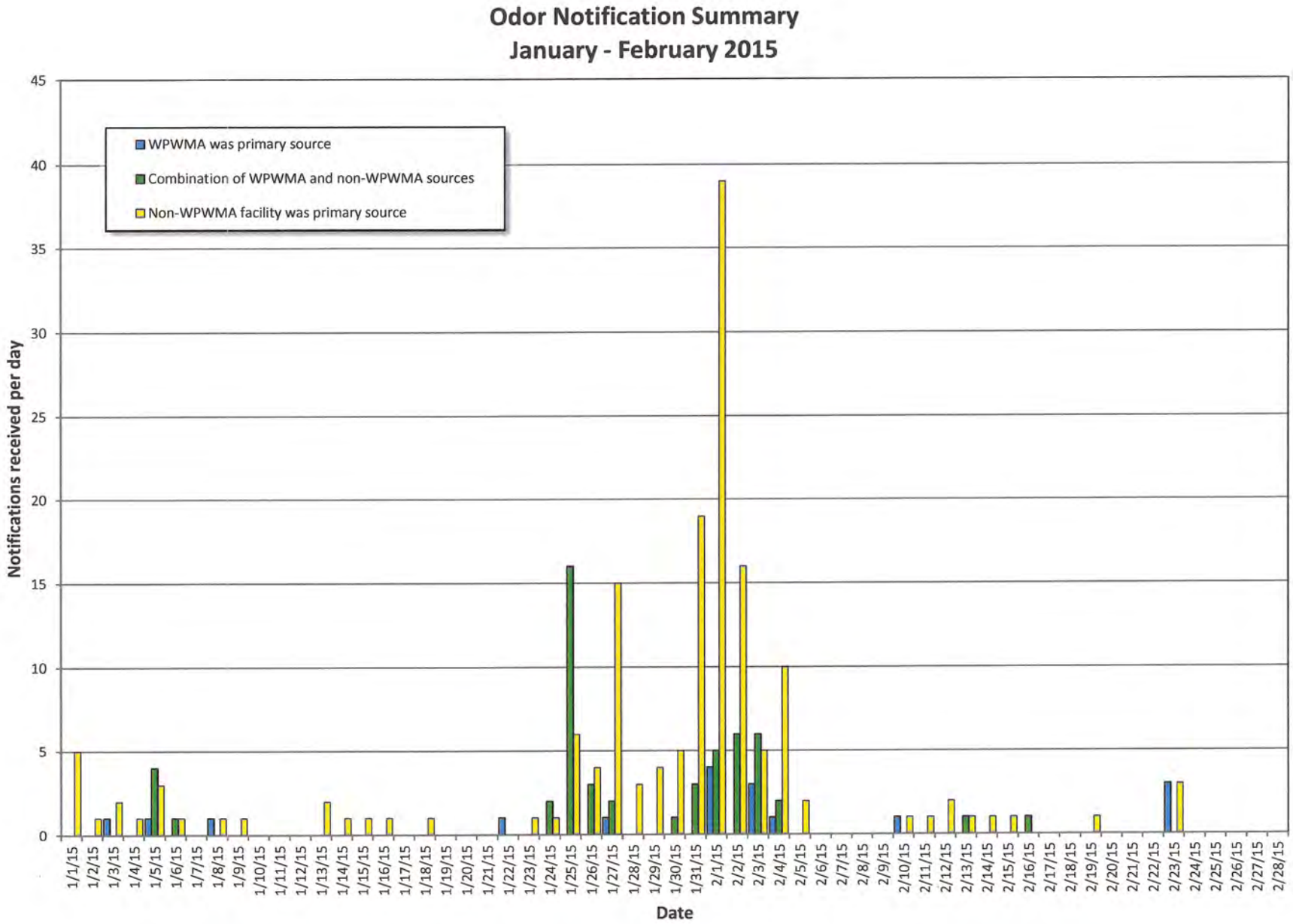
definitively assess the health risks (if any) of these odors. Staff will investigate options to conduct such a study and return to your Board at a future meeting with a recommendation.

To provide the public the greatest opportunity to comment and provide feedback on the regional odor issue, staff notified every resident who submitted an odor notification during the subject time period (and who provided their email address) of tonight's meeting and the WPWMA's intent to discuss the recent odor situation. Additionally, staff notified the local neighborhood associations and the Placer County Air Pollution Control District about this item.

ATTACHMENTS: ODOR NOTIFICATION LOCATION MAP
ODOR NOTIFICATION CHART – SUMMARY OF ODOR NOTIFICATIONS BY DAY
DOCUMENTS RELATED TO HEALTH IMPACTS OF LANDFILL GAS AND COMPOSTING OPERATIONS

MD:eo


Legend
Primary odor was from WPWMA's facility
Combination of odors from WPWMA's facility and other non-WPWMA, off-site facilities
Primary odor was from a non-WPWMA, off-site facility
Non-WPWMA, off-site potential odor source
SCALE (miles)
0
1/2
1
N
Lincoln WWTP
Dairy
Poultry Farm
Thunder Valley Casino WWTP
Green Solutions - Chipping and Grinding Ops
Invirotec
WPWMA's Facility
Rio Bravo
Roseville Peaking Power Plan
Mallard Creek Shavings
Placer Propane
C & R Landscape - Chipping and Grinding Ops
Roseville PG WWTP
65
Alan S. Hart Fwy


Odor Notification Summary
January - February 2015
WPWMA was primary source
Combination of WPWMA and non-WPWMA sources
Non-WPWMA facility was primary source
Notifications received per day
Date

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

Contractor's Report to the Board

Comprehensive Compost Odor Response Project

Produced under contract by:

SAN DIEGO STATE UNIVERSITY

March 2007

INTEGRATED WASTE MANAGEMENT BOARD

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

Introduction

Odor is generally recognized as *the* critical issue for composting. Odor has been called composting's "Achilles heel" (Wilmink and Diener, 2001), a "thorn" in the side this otherwise environmentally-friendly pursuit (Haug, 1993) and "the issue" in public acceptance of composting facilities (McGinley and McGinley, 2005) and the "number one reason" for the closure of facilities (Cotton, 2005). More than any other factor, odor stands in the way of widespread adoption of composting and the many benefits that accompany composting and compost use.

It was once commonly believed that the presence of odors signaled a "problem" at the composting facility. The premise for this belief was that composting, a natural aerobic biological process, does not generate odors *when properly practiced.* The logic was – "if there is an odor, then something has gone wrong with the process." This paragon still persists in some circles. However, several decades of commercial-scale composting practice have convinced most discerning observers that odor generation is an inevitable result of the inevitable decomposition of organic matter – which composting advances.

Odorous compounds inherently form as raw organic materials decompose (Haug; 2004). This fact applies to both aerobic (i.e. with oxygen) and anaerobic (i.e. without oxygen) decomposition, although the latter tends to be much more objectionable. This fact also applies to both naturally occurring organic substances (e.g. leaves) and those resulting from human activities (e.g. biosolids, food residues). Thus, even a low level of odor generation can build into detectable odors when large volumes of decomposing organic materials are amassed in one location. If these odors *always* dissipate before leaving the composting site, all would be well, but that is not *always* the case.

Recognizing the reality—that the formation of odorous compounds is an unavoidable fact—the composting industry has shifted its odor control emphasis from perfecting the process to managing the facility. The goal is to reduce the impacts of odors on the community to acceptable levels. The ideal is to eliminate the impacts. The hope is to limit the impacts to some level of tolerance.

Managing odors to minimize impacts still requires knowledge of, and attention to, the composting process because the process largely determines the level and type of odors generated. However odor management also requires knowledge of, and attention to, other factors including feedstock characteristics, odor sources, odor release and meteorological and geographic conditions. These factors affect odor dispersal and travel, odor containment, treatment methods, materials handling, air handling, facility siting, predictive modeling, odor chemistry, odor measurement, community relations and politics. The conditions that lead to an off-site odor impact can be complex.

This report summarizes the current state of knowledge and practice concerning the odor impacts from composting facilities. The information has been drawn from a variety of publications and references, primarily related to composting specifically. However, literature associated with other odor-relevant fields was consulted including wastewater treatment (WWT), municipal solid waste management (MSW), agriculture and industrial processes (e.g. rendering). In order to address the complexities of odor incidents, the report examines the following questions:

- What are "odors" and what are their effects?
- How are odors detected and measured?

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

- What chemical compounds are responsible for odors at composting?
- What conditions lead to the formation of odorous compounds?
- What conditions and factors lead to off-site impacts (e.g. odor complaints)?
- What determines the severity of off-site impacts?

Together the answers to these questions address the broader question: what causes, conditions and factors lead to odor problems from composting facilities? The next broad question to ask is: how can these odor problems be resolved, anticipated and prevented?

What Are "Odors" and What Are Their Effects?

Before questioning what causes odors, it is helpful to understand just what constitutes an "odor." An odor, or smell, is the sensation that our brains generate in response to certain chemicals in the air and breathed in through the nose (Dalton, 2003b). The stimuli for odors are airborne environmental chemicals – "odorants" or odorous compounds—those react with receptors in the nose and, in turn, produce the odor sensation in the brain. Examples of chemicals that commonly translate to odors at composting facilities include ammonia, hydrogen sulfide, dimetheyl sulfide, butyric acid, putrascene and terpenes. These chemicals arise in nature, as a result of the decomposition of organic substances. The resulting odors are our perceptions of them. Humans can perceive most odors even at relatively low concentrations of the chemicals, in parts per billion in many cases (Dalton, 2003b).

Perhaps because they are perceptions, odors are subjective. Humans differ in their sensitivity to the odorous compounds in the air. Where some people detect an odor to be strong, others sense it as weak or even non-existent (Schiffman, 1998). In addition, people differ in their reaction, preference and aversion to the odors that they perceived. An objectionable odor to one person can be tolerable to another. The perception of odor depends on both the characteristics and concentration of the odorant and the characteristics of the person smelling the odorant (see later section).

A person can find an odor to be pleasant or objectionable, depending on the nature of the odorants and their concentration. In composting situations, odors imply an objectionable sensation. When an unpleasant odor persists or occurs frequently, especially in an unexpected location, it is likely to create a nuisance and lead to complaints. Odor complaints are often accompanied by claims of impaired health from exposure to the odors (Schiffman et al., 2000). However, there is little evidence linking odors directly to physiological effects at the odorant concentration levels typically found outside of composting facilities (or livestock farms or waste treatment facilities) (Cain, 2006; Dalton, 2003a; Shiffman et al, 2003).

How Humans Perceive Odors—The Human Olfactory System

Human odor sensation starts when air is breathed in through the nose. Some of the air breathed in passes through the olfactory system of the nose—a serpentine pathway with protrusions, hair-like cilia, mucous membranes and chemical receptor-cells that together filter and react with numerous chemical compounds (i.e. odorants). The part of the nose containing the odor receptors is the olfactory epithelium, which is situated in the upper

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

and back section of the nose. During normal breathing, approximately 10 percent of the air breathed in passes to the olfactory epithelium (Dalton, 2003b). Deliberate or involuntary sniffing can increase that to 20 percent (Chiumenti et al., 2005). Through a series of chemical reactions, signals travel from the odor receptors to nerves in the olfactory bulb, which translates the signals to the brain (Dalton, 2003b). How the brain processes these signals and relates the odor sensation to experiences and memory is apparently complex and not completely understood (Shiffman, 1998).

Two separate nerve systems are at work, each creating a different type of sensation in response to airborne chemicals (although the brain combines them into a single perception of the odor). The first, known as the first cranial nerve, or olfactory nerve, generates perceptions associated with the qualities of odor – flowery, fruity, putrid, etc. (Dalton, 2003b). The second system, the fifth cranial or trigeminal nerve, produces sensations of irrigation or pungency. The odor sensations from the olfactory nerve apparently do not produce a physiological response (Dalton, 2003b). However, sensations from the trigeminal system can produce responses such as a running nose, red eyes or sneezing when an irritant, like ammonia, is detected in sufficient quantity (Das, 2000; Dalton, 2003b). The chemical concentrations required to trigger irritation from the trigeminal system are typically many times (>7x) greater than the concentrations at which odors are detected (Haug, 1993; Dalton, 2003b, Wilmink and Diener, 2001).

Odors as a Nuisance

Malodors are primarily considered to be a nuisance. The term nuisance has taken on a legal meaning because of conflicts between neighboring land uses (and not necessarily on adjacent land). In general, a nuisance occurs when one person interferes with the right of other people to enjoy their own property or life (Brant and Elliott, 2004). Each state has its own statutory or judicial definition, which generally follow this general definition. McGinley et al. (2000) list the following examples:

- "Anything which is injurious to health, or indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, is a nuisance." (Minnesota)
- "...air contaminants (including odor) in quantities and duration to injure human health and welfare." (Alabama)
- "...unreasonably interfere with enjoyment of life and property." (Alaska)
- "...unreasonable interferes with the comfortable enjoyment of life or property of a substantial part of the community." (Arizona)
- "...Odor constitutes a nuisance if it unreasonably interferes with the enjoyment of life or use of property." (Connecticut)
- "...odors beyond his property...to create a public nuisance... defined includes affecting a considerable number of persons and injurious to health or interfere with the comfortable enjoyment of life and property." (Montana)

In determining whether an odor, or any other intrusion, constitutes a nuisance, courts usually apply the concept of "reasonableness" to the situation (Brant and Elliott, 2004). For instance, it may be necessary to determine if a composting operation is reasonably well-managed and took reasonable steps to prevent odor impacts. Also, it may be questioned whether the complaining neighbors are being reasonable in their demands to

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

eliminate or reduce the odor levels. Farms, and on-farm composting, are often afforded more protection against nuisance complaints because the nature of farming (i.e. inherently odorous) and because of their historic connection to the land. Nevertheless, even farms must operate in a reasonable manner to retain that protection.

In California, the regulation of nuisance odors is more procedural and official than in most other states. All commercial composting facilities in California are required to "prepare, implement, and maintain" a site-specific Odor Impact Minimization Plan or *OIMP* (Title 14 California Code of Regulations, Chapter 3.1 §17863.4; California Integrated Waste Management Board. 2005).

The OIMP process was developed as a response to legislation that gave primary authority over odor complaints at composting facilities to the CIWMB (Health and Safety Code 41705), but required the CIWMB to develop odor regulations and procedures. The OIMP process relies on a philosophy of constant improvement, rather than prescriptive standards. California does not have numeric criteria for when an odor becomes a nuisance. Rather, a facility handling compostable organic materials is required to prepare, implement, and maintain an OIMP. The OIMP must describe design and operational procedures for minimizing odors.

The OIMP also describes meteorological conditions and a complaint response protocol. The OIMP and the facility are typically inspected monthly (although some types of facilities are inspected quarterly). The LEA determines whether or not the facility has an OIMP and is implementing the practices described in the OIMP. If the LEA finds that the facility is not implementing the procedures outlined in its OIMP, the LEA may issue a Notice and Order. If the LEA finds that the OIMP is being fully implemented, but odor impacts are still occurring, the LEA may require the operator "to take additional reasonable and feasible measures to minimize odors." A complete copy of the regulations relating to Odor Impact Minimization Plans is contained at the end of this chapter.

At best, an unpleasant odor is annoying and makes one uncomfortable. However, because people react strongly to unpleasant odors, the word "nuisance" may seem too mild of a term. Odors bring information to a person about the surrounding environment (Dalton, 2003b). Odors say whether the things before us are good or bad, safe or dangerous.

Odors provide clues about food (e.g. good to eat or spoiled), substances to avoid that might harbor disease (e.g. fecal matter) and even the presence of danger (e.g. smoke). While some of these association are subconscious, rooted in evolution, others are more deliberate. For example, Dalton (2003) explains that before microorganisms (i.e. germs) were discovered, disease and sickness were attributed to the "miasma" of the ambient air. Because odors defined the character of the air, odors were considered a cause. The association between odors and disease still persists, even though it is well known that germs cause disease, not the chemicals that generate odors.

Considering the vital information that the sense of smell provides, particularly as primordial function, it is understandable why malodors bring such a strong reaction. People continue to equate bad odors with bad things. To many people odors imply risks, hazards and danger. Ironically, people have apparently become more sensitive to and intolerant of odors, even while the risks in the environment have declined and air quality has improved. Dalton (2003) attributes this phenomenon to the fact that there is less a background odor, or odor "noise" to distract us. With little background odor, people better detect and concentrate on individual odors, and their risks. The relatively clean

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

background environment makes even low levels of odor standout as unusual and intolerable.

Odors and Health

With the possible exception of enclosed spaces and vessels, the chemical compounds responsible for odors at a composting facility are not present in large enough concentrations to cause direct physiological harm (Dalton, 2003b; Pelossi, 2003). That is, the concentrations are below the threshold levels that cause irritation via the trigeminal system. Yet, people still claim to experience symptoms of ill health due to odors. The symptoms most often reported include nausea, eye, nose and throat irritation, headache, shortness of breath and drowsiness (Chiumenti et al., 2005; Schiffman, 1998). Without a cause-and-effect relationship, the question that follows is: Are the symptoms real (i.e. physiological) or perceived (i.e. psychological)?

The answers offered by researchers are not definitive but appear to suggest that symptoms arise from people's reaction to odors rather than a direct physiological effect. In 1998, a conference of experts, held at Duke University, examined the potential health effects of odors from livestock farms, wastewater treatment and biosolids recycling (Schiffman et al., 1998). The participants identified the following three ways in which odors might cause health symptoms:

1. A person is exposed to an odorous chemical compound at concentrations high enough to produce sensory irritations. The person associates the symptoms with the odor, although they are actually caused by the chemical odorant. As mentioned above, odorous compounds are rarely present in high enough concentrations to cause direct irritation. Therefore, this situation is not prevalent.

2. A second agent may accompany the odor, such as pathogenic bacteria. The person becomes ill from exposure to this second agent but associates the symptoms with the odor. Although this scenario cannot be easily ruled out, there is little or no evidence that suggests it occurs.

3. Odors at concentrations high enough to be detected but below the irritant threshold affect people in other ways. They change their behavior or thoughts in ways that lead them to experience the symptoms. (For example, when exposed to an odor, a person may alter their breathing by holding their breath, taking shallow breaths or breathing only through their mouths. Hence, they may become light-headed or develop a sore throat (Dalton, 2003b)). Persistent or frequent odors may increase stress, depress a person's mood or cause them to negatively change their behavior in ways that bring on physical symptoms. The conference participants concluded that more research is needed to assess and better understand the associations between these "biological and behavioral/psychosocial factors" (Schiffman, 2000).

Assuming that the third scenario is a reasonable explanation of the situation, one might say that people are making themselves sick in response to the odors. The odors themselves are not the direct cause of the reported health effects. Some odor scientists agree that there is an absence of cause and effect when it comes to health and nuisance-level odors. In an article by Pelosi (2003), William Cain of the Chemosensory Perception Laboratory at University of California, San Diego is quoted, "You can have symptoms from odors you don't like but this is not illness. Most of these are non-specific symptoms that can have any number of origins." Dr. Cain repeated this sentiment at the recent U.S.

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

Composting Council Conference and reiterated his view that there is "almost no" evidence to link the sensation of odors with illness (Cain, 2006).

Are there regulations to protect me?

Before 1979, landfills had few or no controls to protect human health and the environment. Today, landfills are subject to strict regulation under federal laws that help protect people from the hazards and health issues associated with landfill gas.

- **Resource Conservation and Recovery Act (RCRA)**

RCRA has given the federal government the power to regulate the location, construction, and operation of landfills. Though there are no specific requirements for the control of landfill gas emissions, it requires that methane, one of the major constituents of landfill gas, be regularly monitored at the perimeter of a landfill. If methane concentrations exceed a safe level, RCRA requires the landfill operators to report this to state authorities and to take action to correct the problem and reduce explosion hazards.

- **New Source Performance Standards and Emission Guidelines**

To protect public health, the U.S. Environmental Protection Agency requires landfills that produce a certain amount of NMOCs to install gas collection systems that reduce emissions by 98%. This rule will achieve significant reductions in emissions of air toxics such as benzene, carbon tetrachloride, and chloroform.

FOR MORE INFORMATION

Georgia Department of Human Resources

Division of Public Health

Chemical Hazards Program
(404) 657-6534
www.health.state.ga.us/programs/hazards

Georgia Department of Natural Resources

Environmental Protection Division
(404) 362-2550
www.dnr.state.ga.us/dnr/environ

EPA Office of Solid Waste
www.epa.gov/epaoswer/osw

This brochure was adapted from: Agency for Toxic Substances and Disease Registry, *Landfill Gas; A Primer for Environmental Health*. Supported in part by funds from the Comprehensive Environmental Response, Compensation, and Liability Act trust fund through a cooperative agreement with the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services.

DPH00.51HW

LANDFILL GASES AND ODORS

DIVISION OF PUBLIC HEALTH

Environmental Health and Injury Prevention Branch

DHR
Georgia Department of Human Resources

What is landfill gas?

Gases are formed in a landfill when buried wastes decompose (breakdown by bacteria) or volatize (change from a liquid or solid to a vapor). These bacterial and chemical processes create gases that are unlikely to pose any serious health hazards, but they may cause odors that some people find unpleasant.

What do I smell?

The most common type of landfill is the municipal solid waste facility, which accepts household and non-hazardous commercial and industrial waste. It typically contains 60% organic material, such as food and paper. Because organic material tends to produce a great deal of gas, municipal solid waste landfills have the potential to produce odors.

Sulfides and ammonia are the most common sources of odor in landfill gas. Sulfides produce a strong, rotten-egg smell that humans can detect even at very low concentrations. Ammonia produces a pungent odor that many people are familiar with because it is often used in household cleaning products. Both are normally present in the air, regardless of the presence of a landfill.

The Nose

Is landfill gas hazardous to my health?

Landfill gas may cause temporary discomfort, but it is not likely to cause permanent health effects. At extremely high concentrations, humans may experience eye irritation, headaches, nausea, and soreness of the nose and throat. People with respiratory ailments such as asthma are especially sensitive to these effects. However, these temporary conditions are reversed as soon as the gases are reduced or eliminated.

There is another group of chemicals, called non-methane organic compounds (NMOCs), which may be present in the air near a landfill, though they are not likely to reach harmful levels. NMOCs may occur naturally, or be formed by chemical processes. There is concern that long-term exposure to high levels of NMOCs could lead to health problems, but health studies have been largely inconclusive. Currently, there is not enough information about the impacts that lifestyle choices, such as tobacco use, may have on compounding the health effects from exposure to landfill gases.

Many people find the odors emitted from a landfill to be unpleasant. Although these odors are undesirable, no medical attention is usually required. Landfill odors may cause temporary symptoms such as nausea and headache, but their effect on the comfort of individuals is difficult to evaluate, because different individuals may react differently to the same type and intensity of odor.

What other hazards are associated with landfill gas?

The migration of landfill gas creates health and safety concerns when the gas enters buildings and other confined areas. Under these circumstances, landfill gas may contribute to the following hazards:

- **EXPLOSION HAZARD**
  Gases may form an explosive mixture when combined with air in specific proportions. Methane (odorless), is the only gas likely to be produced in high enough concentrations to pose any real explosion hazard. However, methane is only explosive when diluted to concentrations between 5% and 15%. There also must be an ignition source for an explosion to occur.

- **ASPHYXIATION HAZARD**
  Asphyxiation occurs if there is not enough oxygen in the air to breathe. If landfill gases collect in a confined space, they have the potential to create an oxygen-deficient environment. Carbon dioxide is the gas most likely to create an asphyxiation hazard. Symptoms of asphyxiation include headache, increased breathing and heart rate, and dizziness. These symptoms are reversed when exposure is eliminated.

WESTERN PLACER
WASTE MANAGEMENT AUTHORITY

JACK DURAN, PLACER COUNTY, CHAIR
GEORGE MAGNUSON, ROCKLIN
PAUL JOINER, LINCOLN
ROBERT WEYGANDT, PLACER COUNTY
SUSAN ROHAN, ROSEVILLE
MARY DIETRICH, EXECUTIVE DIRECTOR

MEETING OF THE BOARD OF DIRECTORS

AGENDA

March 12, 2015 6:00 PM

Materials Recovery Facility Administration Building
3033 Fiddyment Road, Roseville, CA 95747

Materials related to an item on this Agenda submitted to the Board of Directors after distribution of the agenda packet are available for public inspection at the Clerk of the Board, 3033 Fiddyment Road, Roseville, CA 95747, during normal business hours and at the meeting location immediately before and during the meeting. The Western Placer Waste Management Authority is committed to ensuring that persons with disabilities are provided the resources to participate fully in its public meetings. If you are hearing impaired, we have listening devices available. If you require additional disability-related modifications or accommodations, including auxiliary aids or services, please contact the Clerk of the Board at (916) 543-3960. If requested, the agenda shall be provided in appropriate alternative formats to persons with disabilities. All requests must be in writing and must be received by the Clerk five business days prior to the scheduled meeting for which you are requesting accommodation. Requests received after such time will be accommodated if time permits.

1. Call Meeting to Order
2. Pledge of Allegiance (Director Weygandt)
3. Roll Call
4. Statement of Meeting Procedures (Clerk of the Board)
5. Agenda Approval
6. Public Comment

   This is a time when persons may address the Board regarding items not on this Agenda. It is requested that comments be brief, since the Board is not permitted to take any action on items addressed under Public Comment.
7. Correspondence (Eric Oddo)

   Late-arriving correspondence (If any, distributed at meeting and noted by Chair.)
8. Consent Agenda

   a. Minutes of the Board Meeting held January 8, 2015 — Pg. 3

      Approve as submitted.

   b. Fourth Amendment to the Agreement for the Used Oil Public Awareness Program (Keith Schmidt) — Pg. 7

      Authorize the Chair to sign the Fourth Amendment to Agreement No. 45124 with Ross-Campbell, Inc. to conduct an oil recycling public education and outreach campaign for an amount not to exceed $67,180.
9. Announcements & Information

   a. Reports from Directors — ----

   b. Report from the Executive Director (Mary Dietrich) — ----

   c. Monthly Financial Reports (Valerie Bayne) — Pg. 13

   d Monthly Tonnage Reports (Keith Schmidt) — ----

   e. Quarterly MRF Operator's Report (Nortech Waste) — Pg. 17

f. Quarterly Landfill Operator's Report (Nortech Landfill) Pg. 21

g. Quarterly WPWMA Engineer's Report (Keith Schmidt) Pg. 23

h. Placer Ranch Notice of Preparation Comment Letter (Mary Dietrich) Pg. 27

i. Odor Update (Eric Oddo) Pg. 57

10. Action Items

a. Agreement to Design, and Provide Permitting and CQA Services for an Upgrade to the Landfill Gas Collection and Control System (Keith Schmidt) Pg. 71

1. Direct staff to negotiate an Agreement with Golder Associates, Inc. for design, permitting, and Construction Quality Assurance services during construction for the upgrade to the landfill gas blower/fare station and gas collection and control system, for an amount not to exceed $408,134.
2. Authorize the Chair to sign the resultant Agreement after review and approval by WPWMA Counsel.

11. Upcoming Agenda Items

Identification of any items the Board would like staff to address at a future meeting.

12. Closed Session

Anticipated Litigation:

a. Initiation of litigation pursuant to subdivision (d)(4) of Government Code §54956.9: one potential case.

13. Adjournment

MEMORANDUM
WESTERN PLACER WASTE MANAGEMENT AUTHORITY

TO: **WPWMA BOARD OF DIRECTORS** DATE: **MARCH 12, 2015**

FROM: **MARY DIETRICH / ERIC ODDO**

SUBJECT: **ODOR UPDATE**

RECOMMENDED ACTION:

None. This item is for informational purposes only.

BACKGROUND:

In January 2012 the WPWMA implemented a notification system on its website to make it easier for the public to report to the WPWMA when they experienced odors in the region. Since inception of the on-line notification system, staff has received an average of approximately 15 odor notifications per month.

Beginning in late January and extending into early February, the WPWMA received over 200 notifications regarding odors in the area. Odors were generally reported from the areas south of the WPWMA's facility as well as from the Rocklin area east of Highway 65[1]. The attached map identifies the locations of the odor notifications received in January and February; the attached chart identifies on which days the odor notifications were received. In addition to the increased volume of notifications, KCRA and KXTL news outlets interviewed staff and ran stories about odors in the area on January 26th and 27th, respectively.

Using the WPWMA's continuous odor monitoring system, staff was able to investigate most notifications and make an estimate of the likely source(s) of odors and the relative contribution and intensity of each odor source at the reported locations[2]. Of the 232 notifications received in January and February, data from the WPWMA's odor monitoring system suggests that approximately 7% were primarily related to odors from the WPWMA operations, 23% were a combination of WPWMA and other off-site sources and the remaining 70% were primarily related to off-site, non-WPWMA sources. As part of the WPWMA's investigation of each odor notification, staff provided a summary report of the investigation (via email) to the Placer County Air Pollution Control District and to the individual who filed the notification.

Based on the descriptors of the odors provided by the individuals using the WPWMA's notification system, field investigations by staff and the modeling results from the WPWMA's continuous odor monitoring system, staff were unable to definitively conclude the primary source of the reported odors or the key factors that lead to the apparent increase in odors in the cases where the WPWMA was not believed to be the

[1] Odors were also reported from a location in Auburn, Loomis, at the Sierra College and I-80 intersection and from southeast Roseville on the border with Citrus Heights. Given the distances between these locations and the WPWMA's facility and the weather conditions at the time of the reports, staff believes it is extremely unlikely these odors were related to the WPWMA's operations.

[2] The WPWMA's continuous odor monitoring system experienced a malfunction and went off line on January 23rd. As a result, the system did not record any data for the period of January 23 – 27. Staff utilized other meteorological station data and reviewed available operating data for this period to estimate likely odor sources.

primary source. Staff however believes that the odors experienced during this time frame were from a combination of industrial and agricultural sources in the area – many of which are not quantified in the WPWMA's continuous odor monitoring system. Furthermore, weather conditions during this period were generally cool in the mornings and evenings (when most odors were reported) and often during foggy and/or calm wind conditions. These weather conditions could have served to trap odors near ground level for extended periods of time.

Although the data suggests that a majority of the odors experienced by residents during January and February were not directly related to the WPWMA's operations, staff continue to pursue measures to reduce the frequency and intensity of odors from the WPWMA's facility that may be experienced by local residents. These measures include:

- Installation of a geomembrane cover on the southern slopes of Modules 15 and 16 of the landfill. This partial final closure project (approved by your Board at the August 14, 2014 meeting as part of the Module 5 base liner project) is anticipated to allow the WPWMA to pull more aggressively on the landfill gas collection system in this area thereby reducing the potential for surface emissions (and therefore odors) related to landfill gas. The cover project is anticipated to be completed by early summer of this year.
- Installation of a misting system at the MRF that will apply an odor neutralizer to all residual wastes leaving the MRF prior to burial at the landfill. Staff reported its intent to authorize Nortech to perform this work at the December 11, 2014 meeting and staff anticipates that the system will be installed and operational later this spring.
- Nortech has initiated a pilot study to perform in-vessel, aerated static pile composting of food wastes recovered from the MRF. Since the materials will be composted within an enclosed vessel, it is believed that the odor potential from this operation will be negligible. Additionally, removing highly odiferous, organic materials from the materials sent to the landfill for burial should reduce the odors generated at the landfill.

Additionally, staff are working with Odotech (the manufacturer of the WPWMA's continuous odor monitoring system) to upgrade the monitoring and modeling systems to improve the system's sensitivity and accuracy under low wind and/or stagnant air conditions. Staff has noted that a majority of the odor notifications it receives occur when there is little to no wind.

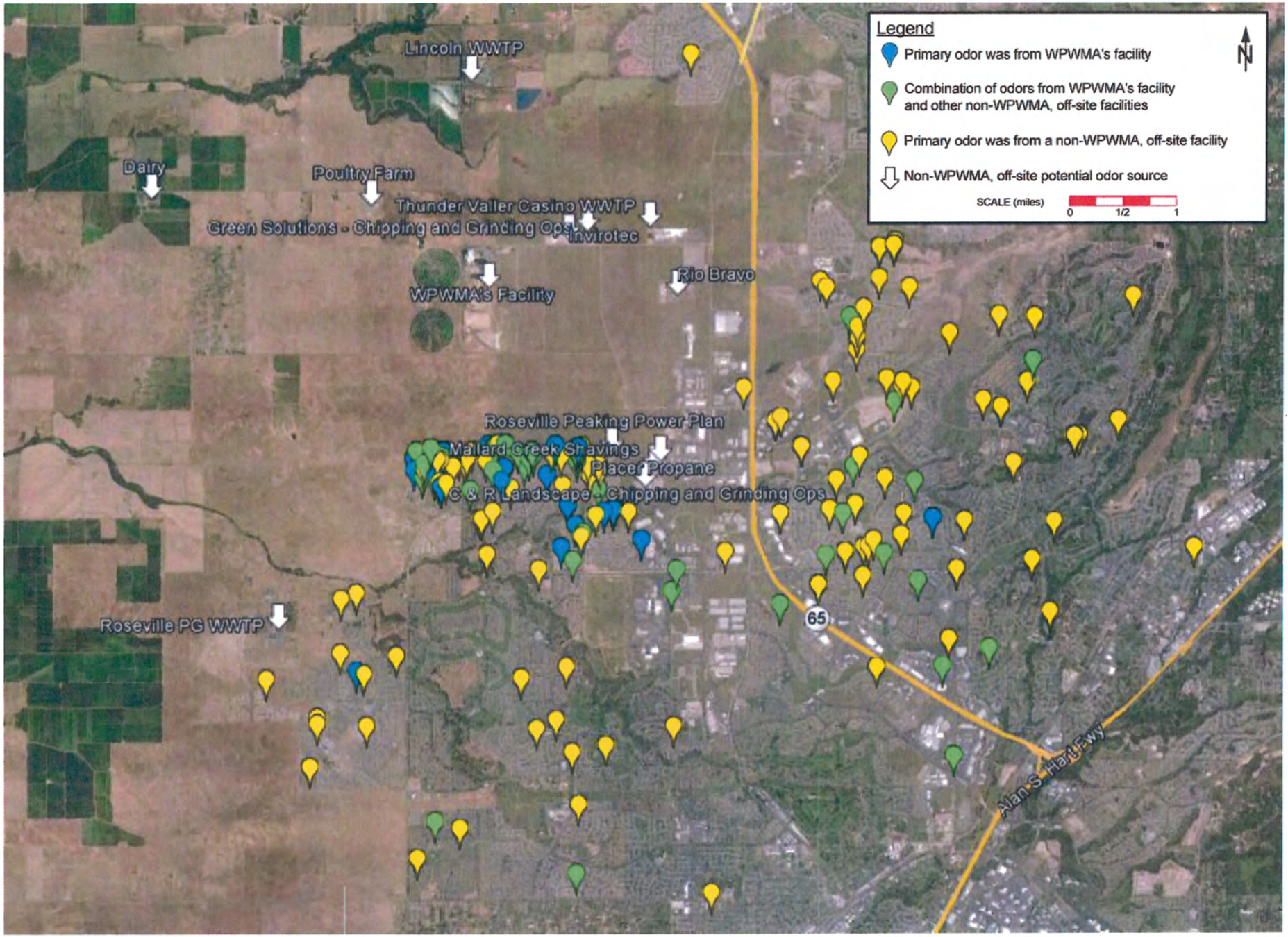
Of the 232 notifications that were received, five individuals questioned whether the odors they experienced pose a health risk. In response to these inquiries, staff provided documents found on-line that suggest that odors from composting operations and landfill gas (likely the main odors from the WPWMA's operations that one would experience off site) generally do not pose any long-term health risks. Copies of these documents are attached for your Board's information. However, as these documents are general in nature, the WPWMA may want to consider conducting a site-specific health risk assessment of the odors generated at the WPWMA's facility to more

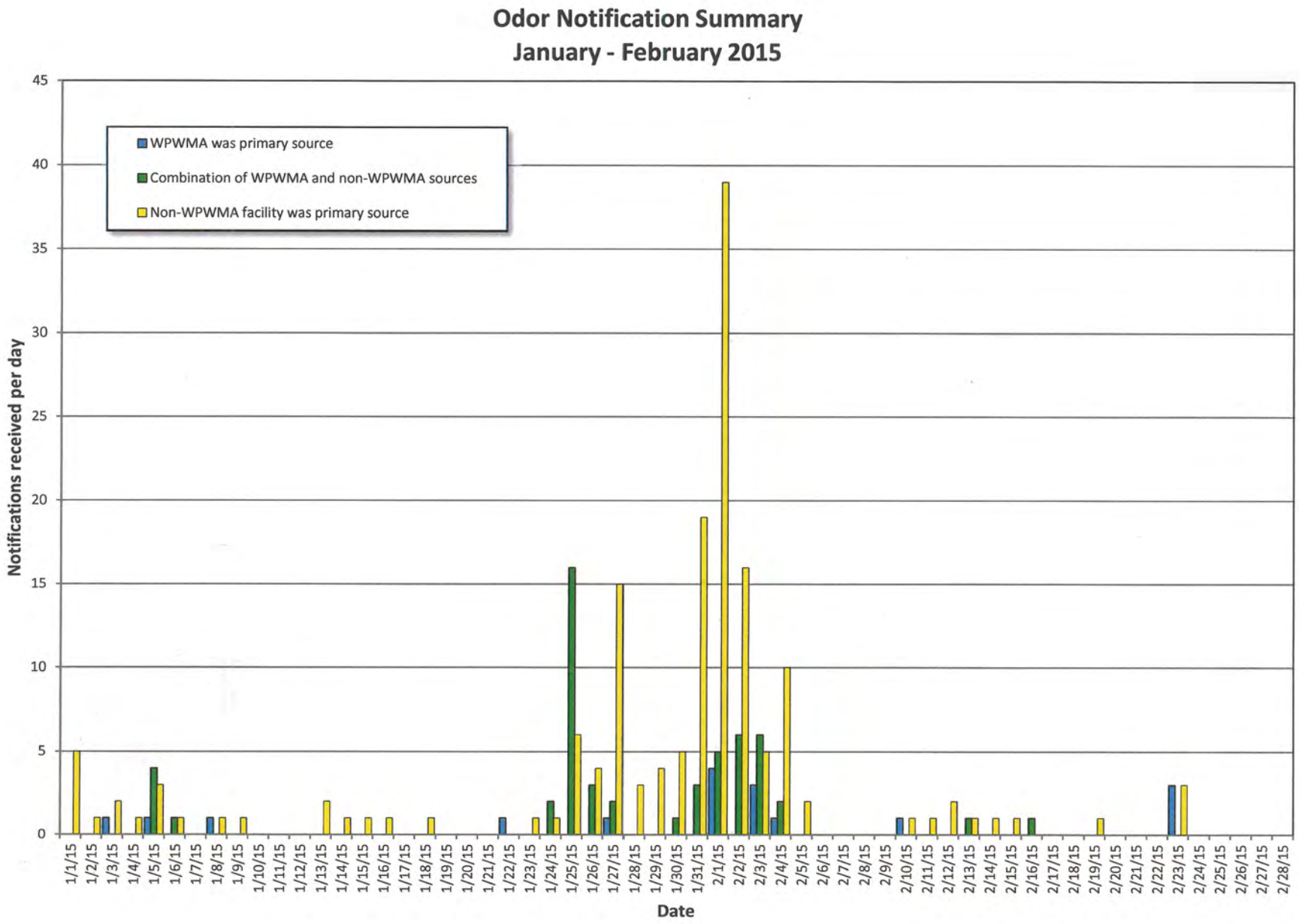
definitively assess the health risks (if any) of these odors. Staff will investigate options to conduct such a study and return to your Board at a future meeting with a recommendation.

To provide the public the greatest opportunity to comment and provide feedback on the regional odor issue, staff notified every resident who submitted an odor notification during the subject time period (and who provided their email address) of tonight's meeting and the WPWMA's intent to discuss the recent odor situation. Additionally, staff notified the local neighborhood associations and the Placer County Air Pollution Control District about this item.

ATTACHMENTS: ODOR NOTIFICATION LOCATION MAP
ODOR NOTIFICATION CHART – SUMMARY OF ODOR NOTIFICATIONS BY DAY
DOCUMENTS RELATED TO HEALTH IMPACTS OF LANDFILL GAS AND COMPOSTING OPERATIONS

MD:eo


Legend
Primary odor was from WPWMA's facility
Combination of odors from WPWMA's facility and other non-WPWMA, off-site facilities
Primary odor was from a non-WPWMA, off-site facility
Non-WPWMA, off-site potential odor source
SCALE (miles)
0
1/2
1
N
Lincoln WWTP
Dairy
Poultry Farm
Thunder Valley Casino WWTP
Green Solutions - Chipping and Grinding Ops
Invirotec
WPWMA's Facility
Rio Bravo
Roseville Peaking Power Plan
Mallard Creek Shavings
Placer Propane
C & R Landscape - Chipping and Grinding Ops
Roseville PG WWTP
65
Alan S. Hart Fwy


Odor Notification Summary
January - February 2015
WPWMA was primary source
Combination of WPWMA and non-WPWMA sources
Non-WPWMA facility was primary source
Notifications received per day
Date
0
5
10
15
20
25
30
35
40
45
1/1/15
1/2/15
1/3/15
1/4/15
1/5/15
1/6/15
1/7/15
1/8/15
1/9/15
1/10/15
1/11/15
1/12/15
1/13/15
1/14/15
1/15/15
1/16/15
1/17/15
1/18/15
1/19/15
1/20/15
1/21/15
1/22/15
1/23/15
1/24/15
1/25/15
1/26/15
1/27/15
1/28/15
1/29/15
1/30/15
1/31/15
2/1/15
2/2/15
2/3/15
2/4/15
2/5/15
2/6/15
2/7/15
2/8/15
2/9/15
2/10/15
2/11/15
2/12/15
2/13/15
2/14/15
2/15/15
2/16/15
2/17/15
2/18/15
2/19/15
2/20/15
2/21/15
2/22/15
2/23/15
2/24/15
2/25/15
2/26/15
2/27/15
2/28/15

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

Contractor's Report to the Board

Comprehensive Compost Odor Response Project

Produced under contract by:

SAN DIEGO STATE UNIVERSITY

March 2007

INTEGRATED WASTE MANAGEMENT BOARD

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

Introduction

Odor is generally recognized as *the* critical issue for composting. Odor has been called composting's "Achilles heel" (Wilmink and Diener, 2001), a "thorn" in the side this otherwise environmentally-friendly pursuit (Haug, 1993) and "the issue" in public acceptance of composting facilities (McGinley and McGinley, 2005) and the "number one reason" for the closure of facilities (Cotton, 2005). More than any other factor, odor stands in the way of widespread adoption of composting and the many benefits that accompany composting and compost use.

It was once commonly believed that the presence of odors signaled a "problem" at the composting facility. The premise for this belief was that composting, a natural aerobic biological process, does not generate odors *when properly practiced.* The logic was – "if there is an odor, then something has gone wrong with the process." This paragon still persists in some circles. However, several decades of commercial-scale composting practice have convinced most discerning observers that odor generation is an inevitable result of the inevitable decomposition of organic matter – which composting advances.

Odorous compounds inherently form as raw organic materials decompose (Haug; 2004). This fact applies to both aerobic (i.e. with oxygen) and anaerobic (i.e. without oxygen) decomposition, although the latter tends to be much more objectionable. This fact also applies to both naturally occurring organic substances (e.g. leaves) and those resulting from human activities (e.g. biosolids, food residues). Thus, even a low level of odor generation can build into detectable odors when large volumes of decomposing organic materials are amassed in one location. If these odors *always* dissipate before leaving the composting site, all would be well, but that is not *always* the case.

Recognizing the reality—that the formation of odorous compounds is an unavoidable fact—the composting industry has shifted its odor control emphasis from perfecting the process to managing the facility. The goal is to reduce the impacts of odors on the community to acceptable levels. The ideal is to eliminate the impacts. The hope is to limit the impacts to some level of tolerance.

Managing odors to minimize impacts still requires knowledge of, and attention to, the composting process because the process largely determines the level and type of odors generated. However odor management also requires knowledge of, and attention to, other factors including feedstock characteristics, odor sources, odor release and meteorological and geographic conditions. These factors affect odor dispersal and travel, odor containment, treatment methods, materials handling, air handling, facility siting, predictive modeling, odor chemistry, odor measurement, community relations and politics. The conditions that lead to an off-site odor impact can be complex.

This report summarizes the current state of knowledge and practice concerning the odor impacts from composting facilities. The information has been drawn from a variety of publications and references, primarily related to composting specifically. However, literature associated with other odor-relevant fields was consulted including wastewater treatment (WWT), municipal solid waste management (MSW), agriculture and industrial processes (e.g. rendering). In order to address the complexities of odor incidents, the report examines the following questions:

- What are "odors" and what are their effects?
- How are odors detected and measured?

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

- What chemical compounds are responsible for odors at composting?
- What conditions lead to the formation of odorous compounds?
- What conditions and factors lead to off-site impacts (e.g. odor complaints)?
- What determines the severity of off-site impacts?

Together the answers to these questions address the broader question: what causes, conditions and factors lead to odor problems from composting facilities? The next broad question to ask is: how can these odor problems be resolved, anticipated and prevented?

What Are "Odors" and What Are Their Effects?

Before questioning what causes odors, it is helpful to understand just what constitutes an "odor." An odor, or smell, is the sensation that our brains generate in response to certain chemicals in the air and breathed in through the nose (Dalton, 2003b). The stimuli for odors are airborne environmental chemicals – "odorants" or odorous compounds—those react with receptors in the nose and, in turn, produce the odor sensation in the brain. Examples of chemicals that commonly translate to odors at composting facilities include ammonia, hydrogen sulfide, dimetheyl sulfide, butyric acid, putrascene and terpenes. These chemicals arise in nature, as a result of the decomposition of organic substances. The resulting odors are our perceptions of them. Humans can perceive most odors even at relatively low concentrations of the chemicals, in parts per billion in many cases (Dalton, 2003b).

Perhaps because they are perceptions, odors are subjective. Humans differ in their sensitivity to the odorous compounds in the air. Where some people detect an odor to be strong, others sense it as weak or even non-existent (Schiffman, 1998). In addition, people differ in their reaction, preference and aversion to the odors that they perceived. An objectionable odor to one person can be tolerable to another. The perception of odor depends on both the characteristics and concentration of the odorant and the characteristics of the person smelling the odorant (see later section).

A person can find an odor to be pleasant or objectionable, depending on the nature of the odorants and their concentration. In composting situations, odors imply an objectionable sensation. When an unpleasant odor persists or occurs frequently, especially in an unexpected location, it is likely to create a nuisance and lead to complaints. Odor complaints are often accompanied by claims of impaired health from exposure to the odors (Schiffman et al., 2000). However, there is little evidence linking odors directly to physiological effects at the odorant concentration levels typically found outside of composting facilities (or livestock farms or waste treatment facilities) (Cain, 2006; Dalton, 2003a; Shiffman et al, 2003).

How Humans Perceive Odors—The Human Olfactory System

Human odor sensation starts when air is breathed in through the nose. Some of the air breathed in passes through the olfactory system of the nose—a serpentine pathway with protrusions, hair-like cilia, mucous membranes and chemical receptor-cells that together filter and react with numerous chemical compounds (i.e. odorants). The part of the nose containing the odor receptors is the olfactory epithelium, which is situated in the upper

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

and back section of the nose. During normal breathing, approximately 10 percent of the air breathed in passes to the olfactory epithelium (Dalton, 2003b). Deliberate or involuntary sniffing can increase that to 20 percent (Chiumenti et al., 2005). Through a series of chemical reactions, signals travel from the odor receptors to nerves in the olfactory bulb, which translates the signals to the brain (Dalton, 2003b). How the brain processes these signals and relates the odor sensation to experiences and memory is apparently complex and not completely understood (Shiffman, 1998).

Two separate nerve systems are at work, each creating a different type of sensation in response to airborne chemicals (although the brain combines them into a single perception of the odor). The first, known as the first cranial nerve, or olfactory nerve, generates perceptions associated with the qualities of odor – flowery, fruity, putrid, etc. (Dalton, 2003b). The second system, the fifth cranial or trigeminal nerve, produces sensations of irrigation or pungency. The odor sensations from the olfactory nerve apparently do not produce a physiological response (Dalton, 2003b). However, sensations from the trigeminal system can produce responses such as a running nose, red eyes or sneezing when an irritant, like ammonia, is detected in sufficient quantity (Das, 2000; Dalton, 2003b). The chemical concentrations required to trigger irritation from the trigeminal system are typically many times (>7x) greater than the concentrations at which odors are detected (Haug, 1993; Dalton, 2003b, Wilmink and Diener, 2001).

Odors as a Nuisance

Malodors are primarily considered to be a nuisance. The term nuisance has taken on a legal meaning because of conflicts between neighboring land uses (and not necessarily on adjacent land). In general, a nuisance occurs when one person interferes with the right of other people to enjoy their own property or life (Brant and Elliott, 2004). Each state has its own statutory or judicial definition, which generally follow this general definition. McGinley et al. (2000) list the following examples:

- "Anything which is injurious to health, or indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, is a nuisance." (Minnesota)
- "...air contaminants (including odor) in quantities and duration to injure human health and welfare." (Alabama)
- "...unreasonably interfere with enjoyment of life and property." (Alaska)
- "...unreasonable interferes with the comfortable enjoyment of life or property of a substantial part of the community." (Arizona)
- "...Odor constitutes a nuisance if it unreasonably interferes with the enjoyment of life or use of property." (Connecticut)
- "...odors beyond his property...to create a public nuisance... defined includes affecting a considerable number of persons and injurious to health or interfere with the comfortable enjoyment of life and property." (Montana)

In determining whether an odor, or any other intrusion, constitutes a nuisance, courts usually apply the concept of "reasonableness" to the situation (Brant and Elliott, 2004). For instance, it may be necessary to determine if a composting operation is reasonably well-managed and took reasonable steps to prevent odor impacts. Also, it may be questioned whether the complaining neighbors are being reasonable in their demands to

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

eliminate or reduce the odor levels. Farms, and on-farm composting, are often afforded more protection against nuisance complaints because the nature of farming (i.e. inherently odorous) and because of their historic connection to the land. Nevertheless, even farms must operate in a reasonable manner to retain that protection.

In California, the regulation of nuisance odors is more procedural and official than in most other states. All commercial composting facilities in California are required to "prepare, implement, and maintain" a site-specific Odor Impact Minimization Plan or *OIMP* (Title 14 California Code of Regulations, Chapter 3.1 §17863.4; California Integrated Waste Management Board. 2005).

The OIMP process was developed as a response to legislation that gave primary authority over odor complaints at composting facilities to the CIWMB (Health and Safety Code 41705), but required the CIWMB to develop odor regulations and procedures. The OIMP process relies on a philosophy of constant improvement, rather than prescriptive standards. California does not have numeric criteria for when an odor becomes a nuisance. Rather, a facility handling compostable organic materials is required to prepare, implement, and maintain an OIMP. The OIMP must describe design and operational procedures for minimizing odors.

The OIMP also describes meteorological conditions and a complaint response protocol. The OIMP and the facility are typically inspected monthly (although some types of facilities are inspected quarterly). The LEA determines whether or not the facility has an OIMP and is implementing the practices described in the OIMP. If the LEA finds that the facility is not implementing the procedures outlined in its OIMP, the LEA may issue a Notice and Order. If the LEA finds that the OIMP is being fully implemented, but odor impacts are still occurring, the LEA may require the operator "to take additional reasonable and feasible measures to minimize odors." A complete copy of the regulations relating to Odor Impact Minimization Plans is contained at the end of this chapter.

At best, an unpleasant odor is annoying and makes one uncomfortable. However, because people react strongly to unpleasant odors, the word "nuisance" may seem too mild of a term. Odors bring information to a person about the surrounding environment (Dalton, 2003b). Odors say whether the things before us are good or bad, safe or dangerous.

Odors provide clues about food (e.g. good to eat or spoiled), substances to avoid that might harbor disease (e.g. fecal matter) and even the presence of danger (e.g. smoke). While some of these association are subconscious, rooted in evolution, others are more deliberate. For example, Dalton (2003) explains that before microorganisms (i.e. germs) were discovered, disease and sickness were attributed to the "miasma" of the ambient air. Because odors defined the character of the air, odors were considered a cause. The association between odors and disease still persists, even though it is well known that germs cause disease, not the chemicals that generate odors.

Considering the vital information that the sense of smell provides, particularly as primordial function, it is understandable why malodors bring such a strong reaction. People continue to equate bad odors with bad things. To many people odors imply risks, hazards and danger. Ironically, people have apparently become more sensitive to and intolerant of odors, even while the risks in the environment have declined and air quality has improved. Dalton (2003) attributes this phenomenon to the fact that there is less a background odor, or odor "noise" to distract us. With little background odor, people better detect and concentrate on individual odors, and their risks. The relatively clean

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

background environment makes even low levels of odor standout as unusual and intolerable.

Odors and Health

With the possible exception of enclosed spaces and vessels, the chemical compounds responsible for odors at a composting facility are not present in large enough concentrations to cause direct physiological harm (Dalton, 2003b; Pelossi, 2003). That is, the concentrations are below the threshold levels that cause irritation via the trigeminal system. Yet, people still claim to experience symptoms of ill health due to odors. The symptoms most often reported include nausea, eye, nose and throat irritation, headache, shortness of breath and drowsiness (Chiumenti et al., 2005; Schiffman, 1998). Without a cause-and-effect relationship, the question that follows is: Are the symptoms real (i.e. physiological) or perceived (i.e. psychological)?

The answers offered by researchers are not definitive but appear to suggest that symptoms arise from people's reaction to odors rather than a direct physiological effect. In 1998, a conference of experts, held at Duke University, examined the potential health effects of odors from livestock farms, wastewater treatment and biosolids recycling (Schiffman et al., 1998). The participants identified the following three ways in which odors might cause health symptoms:

1. A person is exposed to an odorous chemical compound at concentrations high enough to produce sensory irritations. The person associates the symptoms with the odor, although they are actually caused by the chemical odorant. As mentioned above, odorous compounds are rarely present in high enough concentrations to cause direct irritation. Therefore, this situation is not prevalent.

2. A second agent may accompany the odor, such as pathogenic bacteria. The person becomes ill from exposure to this second agent but associates the symptoms with the odor. Although this scenario cannot be easily ruled out, there is little or no evidence that suggests it occurs.

3. Odors at concentrations high enough to be detected but below the irritant threshold affect people in other ways. They change their behavior or thoughts in ways that lead them to experience the symptoms. (For example, when exposed to an odor, a person may alter their breathing by holding their breath, taking shallow breaths or breathing only through their mouths. Hence, they may become light-headed or develop a sore throat (Dalton, 2003b)). Persistent or frequent odors may increase stress, depress a person's mood or cause them to negatively change their behavior in ways that bring on physical symptoms. The conference participants concluded that more research is needed to assess and better understand the associations between these "biological and behavioral/psychosocial factors" (Schiffman, 2000).

Assuming that the third scenario is a reasonable explanation of the situation, one might say that people are making themselves sick in response to the odors. The odors themselves are not the direct cause of the reported health effects. Some odor scientists agree that there is an absence of cause and effect when it comes to health and nuisance-level odors. In an article by Pelosi (2003), William Cain of the Chemosensory Perception Laboratory at University of California, San Diego is quoted, "You can have symptoms from odors you don't like but this is not illness. Most of these are non-specific symptoms that can have any number of origins." Dr. Cain repeated this sentiment at the recent U.S.

This document contains excerpts of the subject report.
The full report is available online at www.calrecycle.ca.gov/publications/Organics/44207001.pdf

Composting Council Conference and reiterated his view that there is "almost no" evidence to link the sensation of odors with illness (Cain, 2006).

Are there regulations to protect me?

Before 1979, landfills had few or no controls to protect human health and the environment. Today, landfills are subject to strict regulation under federal laws that help protect people from the hazards and health issues associated with landfill gas.

- **Resource Conservation and Recovery Act (RCRA)**

RCRA has given the federal government the power to regulate the location, construction, and operation of landfills. Though there are no specific requirements for the control of landfill gas emissions, it requires that methane, one of the major constituents of landfill gas, be regularly monitored at the perimeter of a landfill. If methane concentrations exceed a safe level, RCRA requires the landfill operators to report this to state authorities and to take action to correct the problem and reduce explosion hazards.

- **New Source Performance Standards and Emission Guidelines**

To protect public health, the U.S. Environmental Protection Agency requires landfills that produce a certain amount of NMOCs to install gas collection systems that reduce emissions by 98%. This rule will achieve significant reductions in emissions of air toxics such as benzene, carbon tetrachloride, and chloroform.

FOR MORE INFORMATION

Georgia Department of Human Resources

Division of Public Health

Chemical Hazards Program
(404) 657-6534
www.health.state.ga.us/programs/hazards

Georgia Department of Natural Resources

Environmental Protection Division
(404) 362-2550
www.dnr.state.ga.us/dnr/environ

EPA Office of Solid Waste
www.epa.gov/epaoswer/osw

This brochure was adapted from: Agency for Toxic Substances and Disease Registry, *Landfill Gas; A Primer for Environmental Health*. Supported in part by funds from the Comprehensive Environmental Response, Compensation, and Liability Act trust fund through a cooperative agreement with the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services.

DPH00.51HW

LANDFILL GASES AND ODORS

DIVISION OF PUBLIC HEALTH

Environmental Health and Injury Prevention Branch

DHR
Georgia Department of Human Resources

What is landfill gas?

Gases are formed in a landfill when buried wastes decompose (breakdown by bacteria) or volatize (change from a liquid or solid to a vapor). These bacterial and chemical processes create gases that are unlikely to pose any serious health hazards, but they may cause odors that some people find unpleasant.

What do I smell?

The most common type of landfill is the municipal solid waste facility, which accepts household and non-hazardous commercial and industrial waste. It typically contains 60% organic material, such as food and paper. Because organic material tends to produce a great deal of gas, municipal solid waste landfills have the potential to produce odors.

Sulfides and ammonia are the most common sources of odor in landfill gas. Sulfides produce a strong, rotten-egg smell that humans can detect even at very low concentrations. Ammonia produces a pungent odor that many people are familiar with because it is often used in household cleaning products. Both are normally present in the air, regardless of the presence of a landfill.

The Nose

Is landfill gas hazardous to my health?

Landfill gas may cause temporary discomfort, but it is not likely to cause permanent health effects. At extremely high concentrations, humans may experience eye irritation, headaches, nausea, and soreness of the nose and throat. People with respiratory ailments such as asthma are especially sensitive to these effects. However, these temporary conditions are reversed as soon as the gases are reduced or eliminated.

There is another group of chemicals, called non-methane organic compounds (NMOCs), which may be present in the air near a landfill, though they are not likely to reach harmful levels. NMOCs may occur naturally, or be formed by chemical processes. There is concern that long-term exposure to high levels of NMOCs could lead to health problems, but health studies have been largely inconclusive. Currently, there is not enough information about the impacts that lifestyle choices, such as tobacco use, may have on compounding the health effects from exposure to landfill gases.

Many people find the odors emitted from a landfill to be unpleasant. Although these odors are undesirable, no medical attention is usually required. Landfill odors may cause temporary symptoms such as nausea and headache, but their effect on the comfort of individuals is difficult to evaluate, because different individuals may react differently to the same type and intensity of odor.

What other hazards are associated with landfill gas?

The migration of landfill gas creates health and safety concerns when the gas enters buildings and other confined areas. Under these circumstances, landfill gas may contribute to the following hazards:

- **EXPLOSION HAZARD**
  Gases may form an explosive mixture when combined with air in specific proportions. Methane (odorless), is the only gas likely to be produced in high enough concentrations to pose any real explosion hazard. However, methane is only explosive when diluted to concentrations between 5% and 15%. There also must be an ignition source for an explosion to occur.

- **ASPHYXIATION HAZARD**
  Asphyxiation occurs if there is not enough oxygen in the air to breathe. If landfill gases collect in a confined space, they have the potential to create an oxygen-deficient environment. Carbon dioxide is the gas most likely to create an asphyxiation hazard. Symptoms of asphyxiation include headache, increased breathing and heart rate, and dizziness. These symptoms are reversed when exposure is eliminated.