South Coast
Air Quality Management District
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Odor Detection, Mitigation and Control Technology Forum and Roundtable Discussion October 30, 2007

Forum Summary and Report

Executive Summary
Each year, the South Coast Air Quality Management (AQMD) receives numerous odor complaints. These odors can be persistent or re-occurring at irregular intervals. Odor complaints have been filed from people living in the environs of landfills, Publicly Owned Treatment Works (POTW) refineries, dairy operations, painting operations, and other businesses. Other odor complaints have been filed that are not associated with an obvious source. Identifying the source or sources of these odors can be difficult. Odor mitigation is a challenge not only for odors emitted from unidentified sources but also from those emitted from identified sources. Odors are of interest to agencies such as the AQMD since the public is concerned about the impact of odiferous substances on health and overall quality of life. The inability of AQMD or other agencies to consistently identify odiferous substances, trace them back to their sources, and reassure the public that their health is not endangered has been a concern.

Introduction
On October 30, 2007, the AQMD hosted a one-day technical forum and roundtable discussion where a panel of experts discussed the science of odors, odiferous substance detection technologies, odors as nuisance complaints, the impact of odors on health, and odor control technology. Panel attendee presentations were given during the morning session, and a roundtable discussion followed by panel fielding of public questions was conducted in the afternoon session.

Panel technical experts included:

1. Carol Coy, DEO, Engineering and Compliance, AQMD
2. Thomas H. Morton, Ph.D., Professor of Chemistry, U.C., Riverside
3. Robert Blaisdell, Ph.D., Office of Environmental Health Hazard Assessment, California Environmental Protection Agency
4. Alfred Sattler, Senior Chemist, Sanitation Districts of Los Angeles County
5. Margie L. Homer, Ph.D., Physical Chemist, Jet Propulsion Laboratory, California Institute of Technology
6. Marc Deshusses, Ph.D., Professor of Chemical and Environmental Engineering (Chair),University of California, Riverside
7. Jeff Brown, P.E., Orange County Sanitation District

In addition to these experts, community perspective was presented by Marilyn Kamimura, a Whittier Resident, and Irma Munoz, the Founder of Mujeres de la Tierra.

The afternoon roundtable discussion and public question and answer session was lively with discussion on the relevance of odors and health as a highlight. The contributions of William S. Cain, Ph.D., Chemosensory Perception Laboratory, Dept. of Surgery (Otolaryngology), U.C., San Diego to these discussions were particularly noteworthy. Following is a short summary of the presentations, roundtable discussion, and public question and answer proceedings. Presentation slides, biographies, and abstracts are downloadable as links from the AQMD's Technology Forum/Roundtable Information webpage located at www.AQMD.Gov.

Expert Panel Presentation Summary

1) Carol Coy, Deputy Executive Officer (DEO), Engineering and Compliance opened the morning proceedings and welcomed forum panelist and attendees. After her opening comments, she presented the District's perspective on odor complaints and their resolution. This included an overview on context, relevance, challenges, regulations, the AQMD's overall approach to odor complaint resolution, and the air quality benefits derived from ambient air odor mitigation. Ms Coy stated the AQMD role in odor control is based upon the agency's core responsibility to protect the public's health from air pollution. In fulfilling this role, she stated the AQMD oversees and enforces, as necessary, the regulated community's adherence to air quality regulations, and works to resolve community air quality issues including those from odor emissions. Ms Coy pointed out that AQMD odor complaint resolution activity is mandated under California Health & Safety Code Section 41700, and falls under AQMD Rule 402. This rule on Public Nuisance Regulation states: "A person shall not discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health or safety of any such persons or the public, or which cause, or have a natural tendency to cause, injury or damage to business or property. The provisions of this rule shall not apply to odors emanating from agricultural operations necessary for the growing of crops or the raising of fowl or animals."

Ms Coy reported the number of overall complaints has been in steady decline over the last five years. She stated that odor complaints constituted 50-55% of total nuisance complaints over the last four years. The profile of odor complaints filed has changed over the past decade. Over that time, as a percentage of all odor complaints, odors identified as due to paint and coating operations have declined from 27% to 7% and odors from refuse collection stations has increased from 9% to 34%. Over this same period of time, approximately 12% of odor complaints have not been linked to an identifiable source.

Ms Coy gave an overview of the AQMD's goals and responsibilities in addressing odor complaints. She pointed out the inspector's first responsibility is an assessment as to whether the odor suggested existence of a danger to public health. Inspectors are tasked with contacting complainants, performing area inspections, identifying possible sources, identifying odor quality, collecting samples for laboratory or onsite analysis, serving as a liaison to public health

authorities, issuing notices of violation when a source is implicated and documenting all findings.

Ms. Coy stated there are a number of challenges to successful identification of an odor emission source as well as to odor mitigation. These challenges include the fleeting nature of many odors, variation in complainant odor sensitivity, variation in inspector odor sensitivity, complainant and facility perceptions on whether an odor is a nuisance, air sampling issues and analytical instrument sensitivity limitations.

Ms Coy stated the AQMD works in partnership with facilities and communities to resolve odor and general air quality issues. She concluded her presentation by reminding attendees that the agency can be reached 24 hours a day at 1-800-CUTSMOG (288-7664) for odor complaints, air pollution complaints, emergency response assistance, and smoking vehicle reports.

2) Professor Thomas H. Morton, U.C., Riverside gave a presentation titled the "Chemical & Psychological Dimensions of the Sense of Smell." This presentation provided information on the physical basis of smell and on odor quality perception in humans. Dr. Morton reported that the following conclusions have a basis in experimental fact:

A. In humans, the sense of smell, typically, encompasses two separate responses. The first is chemesthesis, which is the pungency or "feel of an odor" and is sensed via the trigeminal nerve. The second is olfaction, which is sensed via the olfactory bulb located in the brain.

B. Human sensitivity to odors has a remarkably large range.

C. Olfactory response exhibits adaptation which, at least in part, results from signal processing in the brain.

D. Olfactory reception involves the binding of volatile molecules to protein binding sites on the surface of receptor neurons, some of which become attached via covalent bonding.

E. Humans can sometimes differentiate molecules that are non-superimposable mirror images of one another.

F. Human responses and evaluations of odor quality are highly suggestible and can often depend on emotional state.

Professor Morton presented and explained illustrations of the physical structures responsible for the sense of smell. He explained, using examples, the difference between chemesthesis and olfaction. Dr. Morton stated the chemical and physical dimensions of olfaction are not completely understood; however, olfactory detection requires binding of odorant molecules at nerve cell surface receptor sites. He pointed out that permanently binding of molecules to receptor sites can lead to adaptation and/or odor blindness. Professor Morton stated that "hedonic judgments and evaluations of odor quality are highly suggestible and can be subject to the emotional state of the observer".

Professor Morton concluded his talk giving a brief discussion of his research on human contralateral adaptation to various substances including n-butanol.

3) Marilyn Kamimura, a North Whittier Area Resident, provided a citizen's perspective on odors and their impact on quality of life in her neighborhood. Her community is near both a landfill and a trash transfer station. She stated both these facilities had been implicated in odor emissions, but that those suspected as coming from the trash transfer station were the most troublesome. She stated the community's concern that the bad odors were an indication of other problems, including vermin infestation and toxic gas emissions. She stated people living in her neighborhood were impacted such that many were embarrassed to invite relatives or friends to their homes Parents were concerned about the health impact upon their children. And residents were worried the prevalence of bad odors would cause blight due to property owners leaving the neighborhood. She stated the AQMD was more responsive to her community's odor and toxic emission concerns than other agencies, and praised the AQMD's professionalism and dedication to complaint resolution.

4) Irma Muñoz, founder of Mujeres de la Tierra (Women of the Earth) provided a citizens' group perspective on odors and odor mitigation. Mujeres de la Tierra is a volunteer organization dedicated to representing those that feel helpless and hopeless. It has a family unit perspective to addressing issues. The organization recognizes that facilities bring jobs into communities, and that solutions to problems must involve retention of businesses within communities. Hence, the organization's goal is to work with facilities to ensure community concerns are addressed while maintaining the viability of the business staying within the community. Irma presented a case study of affirmative interaction between a foundry, community and Mujeres de la Tierra. Irma encouraged the AQMD to expand the public's awareness of service the agency can provide working with both communities and facilities to resolve air quality issues.

5) Robert Blaisdell, Ph.D., Chief, Exposure Modeling Section, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency gave a presentation titled the "Health Effects of Odors." Dr. Blaisdell started his presentation pointing out that, in nature, odor sensation is a warning system that prevents animals and humans from consuming toxic materials and spoiled food. To do this, the human nose has evolved sensitivity to very low concentrations of odiferous substances. In many cases, this sensitivity exceeds the measurement capability of available instrumentation. Dr. Blaisdell stated odors have been associated with health effects in people living in the environs of paper mills and hazardous waste sites. He stated that odor-associated health symptoms have been reported for substances present at levels far below those known to otherwise cause non-cancer health effects. He also said odor-related symptoms reported in a number of studies include nervousness, headache, sleeplessness, fatigue, dizziness, nausea, loss of appetite, stomach ache, sinus congestion, eye irritation, nose irritation, runny nose, sore throat, cough, and asthma exacerbation. He expanded upon this topic by explaining that odor and irritancy are mediated by different mechanisms, but the thresholds can be similar for many chemicals. Thus many symptoms reported as due to odors could be due to irritancy from associated substances. Dr. Blaisdell concluded his presentation by stating that risk assessment is not much help in evaluating the impact of odors on public health due to the high variability in human odor thresholds which make it difficult to apply standard risk assessment techniques to odors.

6) Al Sattler, Senior Chemist, Sanitation Districts of Los Angeles County (CSDLAC), gave a presentation on Odor Detection and Identification as performed at the CSDLAC. Mr. Sattler began his presentation with a short preamble on the relevance of this topic to the CSDLAC. He explained that the Sanitation Districts of Los Angeles County operate wastewater treatment plants and sanitary landfills within Los Angeles County and that, these facilities have the potential to generate significant odors. He stated the CSDLAC is committed to being a "good neighbor" and committed to regulatory compliance; hence, the Sanitation Districts have invested tens of millions of dollars in systems to capture and treat malodorous air and gas streams. He stated that confirmation that odor removal procedures are working adequately requires a system for measuring odor intensity, and that such a system also demonstrates to the community and to regulators that odors are controlled.

Mr. Sattler discussed the various sample capturing techniques common at the CSDLAC. He discussed the properties and features of Tedlar bags, lung samplers and passivated canisters. He explained that odiferous substances are typically present at very low concentrations, and they are generally very adsorptive ("sticky") or reactive; hence containment vessels and sampling apparatus with inert surfaces are required in odor determination.

At the CSDLAC, monitoring known odorants is performed using a variety of instrumental systems which are employed as "electronic noses" with varying degrees of sophistication. However, Mr. Sattler pointed out, to truly evaluate odor impact, the human nose is still the best detector. He stated the Sanitation Districts' Laboratory currently employs two different olfactometry methods.

The first method is triangular forced-choice dynamic dilution ascending concentration series olfactometry, with an odor panel of six to ten odor assessors. Odor assessors are CSDLAC staff members that are screened to ensure they have a "normal" response and sensitivity to odors common to CSDLAC operations. These assessors are non-smokers who do not eat strongly flavored foods, and do not use perfume or other odorized products several hours prior to serving on the odor panel. Odor assessors smell greatly-diluted gas samples, and the dilution ratio is gradually decreased until an odor is detected. This method is used in semi-routine monitoring of air streams before and after odor-scrubbing treatment within the facility.

The second method uses gas chromatography/mass spectrometry-olfactometry. In this technique, a process sample is separated into its various gaseous components using gas chromatography. The sample stream is then split into three parts; one portion is sent to a mass spectrometer and the remaining portions are sent to two sniffer ports. Odor assessors inhale the gases emitted into the sniffer ports and then use a signal generator to indicate the strength for each odor. In addition, they record odor characteristics. By correlating the retention time for a detected odor to that of a corresponding mass chromatogram peak, it is possible to identify the odorant through mass spectral pattern matching.

As a concluding statement, he staid that the ability of both olfactometry methods to satisfy their intended use requires good sampling techniques, and that without this "a sample is worthless and the entire analysis is, therefore, worthless".

7) Margie L. Homer, Ph.D., Physical Chemist, Jet Propulsion Laboratory, California Institute of Technology gave a presentation titled the "Use of the JPL Electronic Nose to Detect Leaks and Spills in an Enclosed Environment". This presentation provided information on instrumentation designed to sense chemical leaks and odors in a manner similar in operation to the human nose. The JPL electronic nose (ENose) is an adaptation of technology developed in the Professor Nate Lewis research group at California Institute of Technology. Dr Homer explained the ENose was developed to satisfy the need for the rapid, early identification and quantification of substances that could leak, spill, or result from electrical fires or insulation charring aboard the space station. In addition, there was a need to monitor the effectiveness of clean up operations in the event of a chemical leak, spill or fire.

Dr. Homer discussed the use of sensing arrays to detect, identify and quantify specific compounds in a complex background matrix as a preamble to her discussion of application of the ENose in the International Space Station and aboard Space Shuttles. She discussed the principles upon which polymer-based sensors operate in the sensing of both inorganic and organic substances. She discussed limitations of the ENose and advantages of its use. Advantages of the second and third generation systems include real-time analyte monitoring, low weight, low power usage, and low maintenance requirements. The chief limitation of the second and third generation ENose is its applicability to sensing only a small group of analytes.

Dr. Homer defined the JPL ENose as an array of semi-selective chemical sensors which change in electrical resistance when environmental composition changes. She explained that the JPL ENose currently incorporates 32 polymer/carbon composite conductometric sensors. This detection system is a second generation instrument that has been trained to detect, identify and quantify 24 chemical species including ammonia, hydrazine, acetone, ethanol, freon 218, methanol, 2-propanol, toluene and formaldehyde. These substances were selected for monitoring since they are substances that could be released through a leak or a spill in a spacecraft crew cabin. The instrument observes the "fingerprint" pattern of target analytes. Although these fingerprints overlap, they are readily deconvoluted using internal software for analyte identification and quantification. The ENose has been ground-tested extensively, and includes data analysis software for real-time event detection.

The JPL ENose team is developing a third generation ENose. In the second generation system, the ENose was trained to sense common organic solvents and a few selected inorganic compounds. In the next generation system, mercury and sulfur dioxide detection capability will be added. In order to detect these inorganic species, the sensor array will incorporate a hybrid sensor system consisting of new sensing materials and a new sensing platform. This platform will contain innovative micro hotplate sensor substrates.

Dr. Homer concluded her presentation stating that there are a number of additional applications of the ENose technology in addition to use in space vehicle cabins, including general environmental monitoring, medical diagnosis, planetary exploration, military combat air quality monitoring, and industrial process control.

8) Marc Deshusses, Ph.D., Professor of Chemical and Environmental Engineering (Chair), University of California, Riverside gave a presentation titled “Using Odor Science and Green Engineering to Better Control Odors”.

Professor Deshusses began by discussing the relationship of odor nuisance to odor control. Dr. Deshusses pointed out that consensus on a standard definition for what constitutes an odor nuisance has not been reached. He stated that odor is not a compound, but is a collection of attributes applied to the olfactory sensing of a compound. Among these attributes are the perception of odor concentration and intensity which are often described by investigators by relating them to varying concentrations of butanol. Odor character and hedonic tone are also attributes of odors and they are typically described according to a pleasantness scale.

A common methodology for assessing the magnitude of an odor nuisance is by performing odor profiling. In this method, a panel of odor assessors smell sample gas and a record is made of an odor’s attributes. This methodology is labor intensive, requires careful selection and training of panelists, and it is only applicable to supra-odor threshold assessments. Odor panels are also used to describe unknown odors relative to known odors or substances. Examples of substances that are used as odor references are geosmin for earthy odors, trimethylamine for fishy odors, and hydrogen sulfide for rotten egg-like odors. Analysis of samples using GC-MS or other instrumental techniques can allow correlation of odors to specific substances.

Categorizing odors against known odor quality and odor characteristic references allows construction of odor wheels. Typically, odor wheels are constructed with inner circles consisting of broadly defined categories, such as an odor is like sulfur, and outer circles consisting of subcategories, such as an odor is like rotten vegetables.. Additional features that can be added to odor wheels are the chemical sources for odors, such as hydrogen sulfide for sulfur-like odors reminiscent of rotten eggs. The chemical source name is typically placed along the outer perimeter of an odor wheel. Odor wheels are useful in assessing measurement and treatment options.

Odor control can entail process modifications, gas dilution, odor masking, odorant removal by condensation, removal by oxidation or reduction, adsorption , chemical scrubbing or biological treatment.

Professor Deshusses dedicated the remainder of his presentation to discussing the biological treatment of odors, with emphasis on application of high performance biotrickling filters applied to odor removal from wastewater gas emissions. Biotrickling filters (biofilters) use bacteria-impregnated filters to remove unwanted substances from gas passing through the filter. Biofilters have been demonstrated as effective for significant removal of low concentrations of hydrogen sulfide from gas streams. Hydrogen sulfide levels at 100 ppm typically demonstrate 97-99 % hydrogen sulfide removal at 1.6 – 2.2 seconds gas contact time with the filter bed. Biofilter users have successfully converted chemical odor treatment towers to biofilter scrubber towers. High hydrogen sulfide removal ratios at short contact time are reliably observed when facilities use high-quality packing material/bacteria support, ensure a high mass transfer rate which entails high-velocity gas flow over a tall support bed, ensure foul air is well distributed across the diameter of the support bed without “short-circuiting”, ensure sufficient nutrients and carbon

dioxide are present to promote high and healthy bacterial populations, and controltemperature within the bacteria's optimal growth range.

Professor Deshusses concluded his presentation reminding the audience that odor science is constantly progressing and evolving, and that residual odor control poses interesting challenges. He cautioned that the successful treatment of residual odor requires a detailed characterization of the odor, a study of the proposed odor treatment methodology under well controlled conditions, and good engineering design of control equipment.

Roundtable Discussion

Highlights from the roundtable discussion include the following questions and topics. This summary consists of paraphrasing and consolidation of the discussions. The roundtable discussion was far more interesting and comprehensive than can be summarized here. Interested persons are encouraged to view the recorded proceedings to hear discussion of topics not summarized below.

Question #1: Has technology such as the JPL ENose been applied to the monitoring and control of gases emitted at wastewater treatment facilities or in other environmental applications?

Response: Dr. Homer stated the JPL ENose has not been applied to these applications, but commercially available e-noses have been applied to the monitoring of benzene, toluene and xylene emissions from ground water. Dr. Homer also stated that the University of North Carolina has used e-noses to monitor the effectiveness of biofilters in removing odors produced from swine farming operations. Other examples can be found in the literature and on the internet, and instrumentation is commercially available for many applications.

Question #2: What is the relevance of the information presented at this forum to communities and citizens?

Response: Marilyn Kamimura – The information was very helpful to her understanding and raised a question in her mind: Are biofilters more efficient than carbon filters in removing odors (from trash collection facilities). Jeffrey Brown, Senior Engineer, Orange County Sanitation District, responded that carbon filters, though more expensive than biofilters, remove a larger variety of substances than biofilters, which are very good at removing some substances like hydrogen sulfide.

Response: Irma Munoz – Can carbon filters be regenerated or are they disposable? Jeff Brown responded that this depended on the situation.

Irma Munoz – Stated that "there is clearly more to an odor than just the smell", but the public just wants the odors to go away. Irma found the entire forum dialogue informative and now realizes the issue is much more complicated than she thought before.

Question #3: Who serves on odor panels? Are they average people?

Response: Sattler – Generally they are average people who can smell odors.

Response: Professor Morton – This issue is more complicated than the simple answer that odor panels are composed of average people. People's sensitivity to odors varies greatly even among "average" people. Even people that think they are compromised in their ability to smell odors can be found to have a "normal" sensitivity to many odors.

Question #4: Irma Munoz – How does the AQMD handle cases where the complainant alleges a particular source of an odor, but investigation indicates an alternative source?

Response: Carol Coy – When an odor complaint is made, information is recorded regarding time, date, and alleged source. An inspector investigates and files a report stating the "actual" source, if one is identifiable, and indicating whether the source is in compliance with regulations. Other relevant observations from the site of the odor are also reported. The AQMD works with the emission source to mitigate the problem.

Question #5: Marilyn Kamimura – Diesel emissions are a concern of residents living in her community. Are measurements made of diesel soot in the absence of odor complaints?

Response: Carol Coy – Diesel emissions are monitored by determining diesel particulate contribution to the particulate carbon measured through the air monitoring program. Rudy Eden can expand upon this topic.

Response: Rudy Eden, Senior Enforcement Manager, Laboratory Services, AQMD – This topic is one of the most controversial areas in the field of ambient monitoring since diesel emissions are determined indirectly. Anyone that can come up with a way to measure diesel emissions will perform a great service for the public and regulatory communities. Diesel emissions are very complex and the surrogate measurement technique is one based upon the collection and characterization of particulate matter. The Multiple Air Toxics Exposure Study completed in the late 1990s (MATES II) found that diesel emissions contributed about 70+% of the cancer risk in the particulate matter inventory found in the regional air mass. A new Multiple Air Toxics Exposure Study (MATES III) was recently completed and results should be released shortly. They will likely reveal a continued substantial diesel contribution to the particulate matter inventory and health risk in the regional air mass. Rudy explained the controversy behind particulate matter measurement and some of the assumptions that are made to arrive at the diesel particle contribution to total particulates in the regional air mass.

Question #5: Marilyn Kamimura – Follow up question: If the diesel smell is reduced or eliminated is the diesel soot problem also reduced?

Response: Rudy Eden – This is a difficult question to answer as the AQMD has not performed significant dispersion studies on point source diesel emissions in the past. An AQMD report on a recently completed study on diesel emissions near airports will be coming out soon. Aircraft particulate emissions are similar to those observed for diesel engine particulate emissions. The study will show that particulate emissions dissipate very quickly and in as little as 300 meters from the source, particulates are at background levels. How this relates to odor dispersion in this case is unknown. UCLA has performed a study on diesel emissions and dispersal patterns along the 405 freeway (Zhu) and found a similar behavior for diesel particulate dispersion. A second

study is underway at the Roseville Rail Yard (Placer County Air Pollution Control District) and may address the concern behind this question.

Public Comments and Questions

The following is a summary of the Public Comment and Question portion of the Forum. This summary consists of paraphrasing and consolidation of the discussions. Public Comment and Question discussions were far more interesting and comprehensive than can be summarized here. Interested persons are encouraged to view the recorded proceedings to hear comments, questions and discussions not summarized below.

1) Tony Garcia, Almega Environmental – Can a vapor tightness test be performed on rail cars to reduce odor emissions? He also commented that measurement of emissions by TO 14 may be an option for measuring diesel particulates for PAHs.

Response: Rudy Eden – As per the comment, the characterization of diesel emissions for components such as PAHs are in the MATES III study whose results will be released shortly.

2) Dick Pope, Malcolm McCormick – Why are odor complaint action levels based upon complainant's odor detection and not odor recognition?

Response: Al Sattler – The CSDLAC odor panel uses both levels when evaluating odors. This is due to the interest in evaluation of inlet and outlet odors from sanitation district odor scrubbing activities.

Response: Jeff Brown – There is an ASTM standard method and companion European method which establish action levels in the odor detection regime. This may be a result of interest in using a conservative limitation, which protects the public from health effects due to the odorant.

3) Dick Pope had one comment on Dr. Deshusses' presentation where the Professor defined odor nuisance as a matter of concentration and intensity. Mr. Pope would add the additional dimensions of frequency and duration to this definition of what constitutes an odor nuisance.

4) Joe Hower, Environ International, had a comment that in his work on odor issues, a fundamental problem is the close proximity of industrial sources and residential receptors. This problem will get worse as a number of municipalities are converting land from industrial use to residential use.

5) Joe Hower – Does the AQMD talk to municipalities about this issue? (And should the AQMD do this?)

Response: Carol Coy – The AQMD does not have jurisdiction or authority in land-use decisions. The AQMD has prepared a number of documents and performs outreach to municipalities and land-use agencies to increase their awareness of the issues involved in siting of residences near industrial facilities. However, municipalities are striving to create live-work conditions that minimize commute time and the concomitant air pollution from driving between work and home. This creates a balancing act for those agencies making land-use decisions.

Response: Bob Blaisdell – The California Air Resources Board (CARB) is very interested in this issue as well and has issued a guidance document for land use planners. This document can be found on the CARB website.

6) Joe Hower – Odors are the one issue where the philosophy "dilution is the solution to pollution" is valid. Does anyone care how an odor problem is mitigated?

Response: Kamimura, Marilyn – Her community is concerned that simply eliminating odors may not be a proper solution since the odor problem is only part of a complex issue dealing with siting of a high volume trash transfer station within her community.

7) William S. Cain, Ph.D., Chemosensory Perception Laboratory, Dept. of Surgery (Otolaryngology), U.C., San Diego made a comment that humans may be getting less sensitive to odors but only very slowly; on the order of many eons (generations), but the ability to measure odor thresholds has improved tremendously over recent years. This gives the appearance of enhanced sensitivity to odors. The values in odor threshold compilations are as much as two orders of magnitude higher than current methodology is determining. As odor thresholds are better measured, the differences between individuals are found to be smaller. Hence, the idea that attempts at odor mitigation will only remove the problem for a segment of the population is not necessarily a valid one.

8) William S. Cain, Ph.D., made comments on the relationship of odors and health effects. "Odors per se do not cause illness in healthy people." However, the co-travelers with odors such as toxic gases and particulates can be harmful. These are toxicological questions. The question "can the experience of odors actually cause illness" has been considered by Dr Cain's lab. He, and other groups, have concluded that odors, of themselves, do not cause illness. What needs to be studied is the exacerbation of illness in people suffering from an existing illness such as asthma.

9) Carol Coy commented that, some years ago, she was involved in investigations of a landfill producing severe odors and had felt "almost" physically ill while performing her investigations. She also observed the physical decline of residents near a landfill which she thought could be brought on by stress.

Dr. Cain responded that these are symptoms of illness, but not actual illness. And stress is appropriate for people alarmed at sensing particular odors in inappropriate places. Dr. Cain used the example of stable odors. Horse riders are not offended by stable odors in stables, but would be very distraught if these odors were in their living rooms.

10) Steve Erlach, Ventura APCD – What is known about the interaction of very small (ultra fine?) particles on the olfactory system independent of the gases with which they travel?

Professor Morton responded that some animals, such as snakes and blood hounds, have organs implicated in sensing fine particulates; however, it appears that this sensory system is vestigial in humans.

11) Martin Ruben, Concerned Residents Against Airport Pollution – What is the AQMD responsibility for mitigating odors coming from airport operations; particularly from idling jets?

Carol Coy responded this is a controversial issue. LAX is a Title 5 permitted facility and has various permitted equipment. The AQMD has authority over stationary sources of odor and pollution, but does not have authority over jet emissions.

12) Gavin, Pacific Terminals – What happens in the case when a facility is in regulatory compliance, but is the subject of many odor complaints? Does the nuisance rule have precedence over compliance with all other regulations?

Carl Coy responded that the nuisance statute does take precedence and that this situation is not uncommon. This creates the challenge of identifying the odor source and results in expansion of permit conditions to eliminate the nuisance.

13) Skye Patch – Would biofilters be effective in reducing hydrogen sulfide, methyl mercaptan and dimethyl disulfide emissions from pulp mills?

Jeff Brown responded that biofilters would work well removing hydrogen sulfide and mercaptans and would be worth investigating in this application.

14) Skye Patch – Can an E-nose like that used in spacecraft (see Expert Panel Presentation Summary #7; Homer presentation) be applied to monitoring emissions from a pulp mill?

Dr. Homer responded e-noses can work in this application if the sensors were in the “right’ place. A distributed set of sensors is necessary.

The odor forum proceedings were concluded after Ms. Patch’s questions.