



Solid Waste News & Notes

A Newsletter from the Solid Waste Unit of the Hazardous Materials and Waste Management Division

Vol. 1, No. 1

December 1998

"Passing Gas"

Part 1 of a 4 Part Series on Municipal Solid Waste and Landfill Gas

When people "have gas," it usually makes them uncomfortable. When landfill owners and operators "have gas," it may mean something entirely different, and it may make them uncomfortable, as well. Both, however, have much in common — they are the result of natural processes that will happen everywhere to one extent or another, and both can be controlled with precautions or remedies. For landfill operators, it is very important to be aware of 1) the probable presence of landfill gases, 2) their potential hazards, 3) Colorado regulatory requirements, and 4) ways to mitigate problems that do arise. These will be the subjects of a four-part series on landfill gases. In this issue we will discuss, Part 1, Landfill gas: What is it and Where Does it Come From?

Landfill gas is a result of the decomposition of organic wastes buried in a landfill. Municipal solid waste (MSW) contains plenty of material to decompose. It is estimated that two-thirds to three-quarters of waste volumes going to MSW landfills are composed of organic matter — food and yard wastes, paper and cardboard, wood, textiles and plastics. Inert materials, such as soil, brick and masonry, metals and glass, contain no organic matter, and therefore do not contribute to the generation of gases after burial.

Organic matter is composed mainly of carbon, hydrogen and oxygen compounds, called carbohydrates.

Wood and plants, for instance, are mainly cellulose, a carbohydrate polymer $\text{nC}_6\text{H}_{10}\text{O}_5$. Foods and plants contain many carbohydrates. Paper, cardboard, and fiberboard are made from wood, and thus are composed mostly of cellulose.

So, how do these materials become gases? When the wastes are buried, a fair amount of air is captured in the empty spaces — no matter how much compactive effort was applied. Recall that air is a mixture of the gases nitrogen (78%), oxygen (21%), and others — carbon dioxide (CO_2), argon, helium, etc. Exposed to air and ubiquitous microorganisms - bacteria, molds, fungi, the garbage and plant matter begin to rot. The rotting is a form of oxidation, or burning, where the carbohydrates are turned into water vapor and carbon dioxide. The rotten smells come from breakdown of proteins and fatty acids, producing sulfur compounds and odorous organic gases that are released in the process. This type of decomposition continues as long as oxygen is present, and is known as the aerobic stage. Placement of daily cover assists in restricting the supply of air and its oxygen.

When free oxygen is no longer available, that group of microorganisms dies off, but new ones arise that can exist without oxygen - the anaerobic type. (continued on page 2)



Colorado Department
of Public Health
and Environment

Compliance Assistance from the Unit Leader

Welcome to the inaugural publication of *Solid Waste News & Notes*! This newsletter from the Solid Waste Unit is expected to be an on-going event. We hope to provide articles of interest to solid waste customers that are developed by our staff and released several times per year. We plan to keep this newsletter updated on our website at <http://www.cdphe.state.co.us/hm/> and available via hard copy for interested individuals.

We have many articles planned for future editions, but we are very interested in your input. How often should we target new editions, quarterly or semi-annually? What type of subject matter should we present, and in what detail? Should we have regulatory updates from both the state and federal government? What have we forgotten to publish? Any comments that you would like to share with us would be greatly appreciated! Please feel free to call or write to me with comments and questions.

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And they are plentiful. The chemical environment changes from oxidizing to reducing, and methane, CH₄, replaces water as a product of decomposition of the wastes. Further, the anaerobic bacteria are able to break down the cellulose in wood and other hard organic materials. After some time, usually well before much of the cellulose is converted, the protein and fatty materials are used up, so odorous emissions cease. The gases produced from then on are mostly methane and carbon dioxide. These two colorless and odorless gases are produced in approximately equal amounts in a mixture. Although methane is lighter than air (Specific Gravity 0.554) and carbon dioxide is heavier than air (Specific Gravity 1.520), the mixture has about the same density as air. In addition, there may be small to trace amounts of volatile organic and sulfur compounds in the gases during any or all of the phases described above.

The bacterial populations are aided in their development and effectiveness by the presence of water and nutrients. MSW arriving at the landfill typically contains about 25% water. This amount would easily pass the paint filter test (EPA Method 9095), but it is more than enough to allow the aerobic organisms rapidly to get going. As a result, the "MSW aroma" develops rather quickly, and as more water is supplied by the aerobic decomposition, in the presence of plentiful MSW nutrients, gas production usually gets a good start.

Numerous factors affect the generation phases of landfill gases. First, there is the source, the MSW itself: What is the type, proportion and distribution of organic material? Size and surface area? Then, how much moisture? Temperature and pH? Microorganisms and

nutrients present? Generally one can deduce four stages of gas production. It starts with the aerobic stage (Phase 1); oxygen is present producing mainly carbon dioxide and water vapor. Phase 1 lasts weeks to months. Phase 2 begins when oxygen is depleted, aerobic organisms die off and anaerobic bacteria develop. Phase 2 is the anoxic stage, when mainly carbon dioxide and hydrogen are produced. Typically this stage lasts several months. The start of methane production defines the next stage (Phase 3). At first, the rate of methane production (methanogenesis), and other gases, is erratic as the microorganisms develop and spread. This phase may take several months to years. In these early stages, volatile organic compounds may develop and be released if solvents or other organic chemicals are present in the landfill material. At some point, the production of methane and carbon dioxide levels out at a fairly constant rate, in approximately equal amounts of 50% each. This phase (Phase 4) is the most persistent, and usually continues for decades. At the end, when all organic source materials are depleted, landfill gas generation finally stops.

One can only guess the time involved with each phase at a specific site. One observation is certain, however: in Colorado there are several examples of old landfills that have been closed for more than twenty or thirty years that are still producing gases in amounts that may be dangerous. Because these decomposition products are gases, they are free to move, creating a variety of potential hazards. These will be discussed in Part 2 of the landfill gas series: *Hazards of Landfill Gases — Asphyxiation Danger, Explosive Mixtures and Migration*.

—Pete Laux, Solid Waste Unit
(303) 692-3455

SAMS CORNER (#1)

Site Analysis Management System to be Implemented Soon

The Hazardous Materials and Waste Management Division has recently invested in a state of the art data management system. The official acronym for the system is SAMS, which stands for Site Analysis Management System. The core of the system is a commercially available environmental data base product called EQuIS, which stands for Environmental Quality Information System. EQuIS is produced by a company called EarthSoft. If you are so inclined, you may check out their website at <http://www.earthsoft.com>.

We have long recognized a need for a system to adequately contain and utilize the enormous volume of environmental data that the regulated community is required to provide to the Division. With SAMS we now have the technology to store all types of environmental data in an electronic format. SAMS also provides an efficient method to export data to leading edge computer applications that allow us to evaluate and understand solid

waste sites in ways that were beyond comprehension just a few years ago.

We are currently building the first site into SAMS, the BFI Fountain Landfill in El Paso County. This site was chosen for many reasons. We based the selection primarily on the exceptional quality of the available data and the willingness of BFI to cooperate with us. We owe them many thanks!

Building this first site has turned out to be very challenging. We have chosen to enter the information age running. Ultimately, we hope to make SAMS available on the world wide web. Please watch for future editions of *SAMS Corner* as we strive to reach this lofty goal. Come along and enjoy the ride!!!

—Ron Forlina, Solid Waste Unit
(303) 692-3439



REGULATION UPDATE

Public Hearing Scheduled

On **January 20, 1999**, the Colorado Board of Health will hear proposed regulation changes presented by the Solid Waste Unit of the Hazardous Materials and Waste Management Division. The hearing is open to the public.

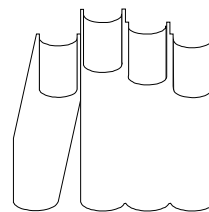
The proposed changes will cover additions to the current financial assurance rules, most specifically a new section for a corporate financial test/guarantee and a section allowing the use of a certificate of deposit; Also, it includes the elimination of the term "special waste" and increased language governing waste characterization; Lastly, the replacement of the current language governing inspection and enforcement with new language derived from the recently enacted HB 98-1324. Further information regarding HB 98-1324 may be found on the Division's web page: <http://www.cdphe.state.co.us/hm/>.

Composting Standards Being Developed

The Solid Waste Unit has been developing draft conceptual composting regulations to complement the current Solid Waste Regulations (6 CCR 1007-2) pertaining to solid waste disposal sites and facilities. The draft regulations were initiated by HB 98-1324 and will address the unique nature and diversity of composting facilities and establish standards accounting for such variety, while continuing to maintain protection of public health and the environment. The Unit has targeted the beginning of 1999 for public review and comment of the draft document.

Recycling Regulations

Work has begun in outlining the concept of a recycling regulation based on the changes enacted to the statute in HB 98-1324. After some additional work with the concept, and with the Office of the Colorado Attorney General, the first conceptual

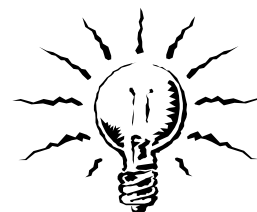


edition should be available in mid to late February 1999.

Input Sought on Construction and Demolition Debris/Inert Material

We are seeking input on concepts of the best way to deal with construction and demolition debris/inert material. As many know, there is a reserved section (Section 4) in the Solid Waste Regulations to address these materials. Several recent events, including a federal direction that may ban construction debris from a traditional landfill and divert it to construction and demolition debris facilities, necessitates the Division looking into this area. Input from the regulated community on this topic would be greatly appreciated.

As always, your input is preferred in written form so that we may establish a legal record. Comments should be directed to Glenn Mallory at the address listed on page 5.



New Air Pollution Regulations for Landfills?

What follows is a letter mailed in October 1998 by Kirsten King of the Air Pollution Control Division of the Colorado Department of Public Health and Environment. We are publishing it in this newsletter as a "heads up" for Solid Waste customers. If you have questions regarding this matter you may call Kirsten directly at (303) 692-3212. We plan on including air quality updates in future issues of this newsletter.

"Dear Sirs:

The EPA is currently developing a new air regulation for landfills under §112 of the Federal Clean Air Act. This regulation may require landfills to install equipment to collect the gases formed when trash decomposes or rots. The new regulation is called a Maximum Achievable Control Technology (MACT) standard. In 1996 the EPA

promulgated a New Source Performance Standard (NSPS). This 1996 regulation covered landfills with design capacities of 2.5 million megagrams (about 2.5 million cubic meters) or larger. The new MACT regulation is likely to cover much smaller landfills and some closed landfills, as well as the larger landfills. The older regulation had a number of problems when it was originally released, it did not accurately address dry and cold areas, such as Colorado, and was confusing regarding the level of permitting required.

I am working with the EPA contractor developing the new MACT regulation, so that the new regulation will address dry, cold areas like Colorado and to the extent possible avoid any duplication or conflicts between the older regulation (NSPS) and the new standard being
(continued on page 4)

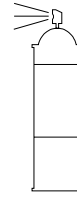
developed (MACT). The Colorado Health Department is working with EPA in the hope that the smaller landfills will be exempted from the new MACT regulation. Your input and assistance toward this goal is greatly appreciated. I have attached a questionnaire that covers the items that EPA wants to cover in the new rule. I am also interested in collecting and sending to EPA any other information you feel would help them as they develop this new regulation. This could include economic data, emissions data, and possibly the distance from the landfill to the nearest populated area.

In order to ensure that your input is considered and that EPA addresses small landfills and appropriate climate issues, I will need to collect as much relevant information as possible, quickly.

Thank you for your assistance. If you have any questions please contact me at (303) 692-3212.

Sincerely,

*Kirsten Linnea King
Air Quality Engineer"*



Tired of Tires

Retired Tire Stockpiles a Concern for Many

Over the past few years a number of large tire piles have developed around the State in both rural and metro areas, at landfills, on public lands and private properties as well. The reason for this is at least two fold. First, landfills may charge a special handling fee for tires, which encourages individuals to look for alternatives that are oftentimes inappropriate. Second, with an emphasis on recycling, individuals and companies may decide that tires have an unrealistic monetary value and begin to stockpile them.

This past year the State, counties, local communities and landfills have begun to address and clean up these unsightly and potentially hazardous mountains. This is being funded in a variety of ways including grants, increased operational budgets, elimination of the additional handling fees and "amnesty days" at landfills. Disappointingly however, it seems that new piles are developing almost as rapidly as others are disappearing. As governments, landfill operators, recyclers or individual consumers there are a number of things we can do to reduce or eliminate this trend.

Government grant funding appears to be an effective way to deal with the identified historical piles. Landfill operators who haven't re-evaluated the need for special handling fees might do so. Many small rural landfills place tires directly into the toe of the daily waste at no additional cost. Facilities receiving a large number of tires may still require special handling but may be able to address the cost through new fee structuring or finding uses for the tires at the landfill. Landfill operations have developed a number of ways to manage tires in the fill such as splitting or quartering and incorporating into the regular waste or monofilling. More recently however, landfill operations have been experimenting with using tires on site for their own beneficial use. Chipping tires to use as daily cover is a good example of this.

The Mesa County Landfill charges a special handling fee for tires but has utilized a number of alternatives to keep the cost low. To manage the resulting large volumes of tires from grant cleanup projects and "Amnesty Days," they have split or quartered tires and monofilled them. *(continued on page 5)*

Customer Service and Compliance Assistance: Our Priority

On Tuesday, December 15, 1998, three members of the Hazardous Materials and Waste Management Division will attend the Great Plains Landfill Operators Meeting in Sterling, Colorado. The Great Plains members - a group of eight counties including Kit Carson, Lincoln, Logan, Morgan, Phillips, Sedgwick, Washington, and Yuma - meet on a quarterly basis to share ideas, solicit assistance, and discuss landfill operations. The members requested a straight-forward presentation, by the Division, regarding the Financial Assurance requirements under the newly revised Solid Waste Statute (CRS 30-20-109), and the Solid Waste Regulations (6 CCR 1007-2).

Division staff is available for regulation-based presentations to other professional associations and individual customers. Please call us if we can help you navigate through regulatory complexities.

—Brenda Lujan, Solid Waste Unit
(303) 692-3335



They also use quartered tires as alternative daily cover. As a recycling effort they propose to bail 100 tires at a time into blocks 5'X4.5'X2.5' weighing up to 2,000 pounds. These large blocks can then be used in stabilization efforts on the slopes and at the toe of the landfill. The blocks will be marketed as a recycled product for erosion control and other uses at approved construction projects. The bails also have potential uses at firing ranges and in low volume dams.

Tires are occasionally used in structures such as houses, barns, fences and other buildings and are quite energy efficient. Tires are not, however, a typical building material. A specific contractor with specialized skills may be required in order to build with them. The use of unique building materials may make a project cost prohibitive. Evaluate these issues *before* accumulating the tires.

Legitimate private recycling facilities may also provide an alternative to landfill disposal of tires. However, many well intentioned operations have resulted in the large tire mountains that are now being remediated by tax payer dollars. Recycling operations should have a well thought out, comprehensive business plan. These facilities should be developed in areas that are zoned for those types of activities. Markets for the recycled product should be identified with some commitment to need or purchase

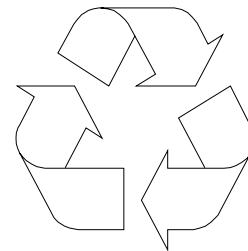
prior to speculative accumulation beginning. A narrative or flow diagram should spell out the entire operational sequence including contingencies for disposal in the event no market exists or the market dries up.

Remember a recyclable material or product exists only if there is a market for it. Otherwise it is a

waste and is required to be managed as one. The best management practice may ultimately be in a landfill.

As consumers, we often encounter additional unplanned costs associated with almost everything we buy. Costs to dispose of things when we are finished with them is nothing new, yet is not considered when a purchase is being made. Disposal costs are then met with some resistance, most likely because what was once an asset or useful item is now simply a liability that wasn't planned for. As responsible consumers perhaps we should do better planning and simply accept the end cost of disposal or shipment to a legitimate recycling facility as part, the final part, of ownership.

—Donna Stoner, Solid Waste Unit - Grand Junction Office
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Solid Waste Unit

Please feel free to contact any of the following individuals for more information, questions or to offer comments:

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We All Win With Wise Waste Management



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