CHAPTER SEVEN

SCREENING THE WASTE STREAM

Waste from construction and demolition projects should be screened as to whether it is appropriate to be reused or recycled and, if those are not options, whether it is C&D waste that can be accepted in a Tribe's own C&D landfill facility or shipped to an off-site facility.

Household waste or MSW is not allowed to go to a C&D landfill because its accelerated decomposition will lead to leachate generation. Liquid waste cannot be placed in any landfill because it--of course--also contributes to leachate generation. Each C&D landfill or transfer station that segregates debris for reuse or for shipping to a C&D landfill or recycler should have waste screening procedures that include active inspection of the debris, rejection of prohibited materials, removal of the prohibited materials for proper disposal, and notification of proper authorities, haulers, and generators. Keep detailed records of waste screening.

Ideally, the initial waste screening will be performed at the point the debris is generated and, therefore, requires that generators be educated on the types of waste that are prohibited and should be excluded from the waste screen from the beginning.

At the landfill, transfer station, or material recycling facility (MRF), the site attendant or a spotter should be on the lookout for prohibited materials.

A Tribe that accepts C&D waste for disposal in its C&D landfill or for shipping to an off-site C&D landfill should develop a Solid Waste Management Plan that should include:

- a list of wastes that will not be accepted;
- the reasons your specific facility will accept or reject certain wastes;
- the procedure you will use to evaluate a waste;
- a procedure for managing the waste; and
- how you intend to inspect incoming waste and record any violations.

Operating personnel must be trained in the above procedures and not allow unacceptable waste to enter the facility. The final decision to accept or reject a waste and the responsibility for the waste's proper handling and liability for future problems lie with the operating personnel. Therefore they must be empowered to make the decision whether to accept or reject any and all loads.

If unacceptable waste does enter a Tribal facility, the Tribe should have a procedure in how to remove the material and, if the material is hazardous, direct if not handle the cleanup of the contamination that may result. Personnel must know what to do if they find unacceptable waste--who to call, how to handle it, and where to place it.

As part of waste screening, worker and overall Tribal safety are a paramount concern. Some materials aren't just unacceptable as C&D waste but they are dangerous for any facility. And there are materials that may be part of loads from a construction and demolition site that are dangerous.

And this brings us to an extremely important point. A successful C&D debris program will employ reuse. If a Tribe develops a C&D debris management program that includes reuse of materials but does not include waste screening, these dangerous materials can harm the Tribe. And this would be the same even if a Tribe does not have such a program and C&D debris and related material are pulled from open dumps for casual reuse.

Imagine the consequences if arsenic-treated wood is used to build Tribal sweat houses or boats for children or put in the mouth of a Tribal member in the traditional process of using wood strips to make baskets. What are the consequences if pipes with asbestos are employed in the frame for a playground swing?

This material is dangerous and must be screened--before it enters a transfer, MRF, or a landfill and before it is reused by anyone.

Dangerous at all costs

Hazardous waste. Hazardous waste is

- Ignitable--with a flash point of less than 140; examples are paint thinners, alcohol, gasoline, solvents, and uncured resins; and/or
- Is an oxidizer--a chemical that supplies oxygen to a reaction when air is absent; examples are peroxides, nitrates, and chlorates; and/or
- Corrosive--with a pH of 2.0 or less or 12.5 or more--strong acids or bases like lye; and/or
- Toxic--examples are paint wastes, some batteries, and electroplating sludges; and/or
- Reactive--meaning waste that is unstable and may react violently when it comes into contact with water or air; an example is a lithium battery; and/or
- PCB-contaminated--with the waste containing 50 parts per million or more of polychlorinated biphenyls.

Hazardous material must be marked and/or labeled by law, but, of course is not if it is illegally dumped. Be on guard for such material. Reject them. Get assistance for proper disposal or assistance with any contamination if the material enters your facilities.

Infectious waste. These wastes include blood, body parts, body fluids, needles, and dressings. These materials can threaten worker safety, attract rodents and insects, and spread disease. They are required by law to be marked but are, again, likely to be unmarked if illegally dumped. Their source are facilities such as hospitals, nursing homes, dental offices, clinics, veterinary offices, research labs, and mortuaries. From a C&D debris perspective, be aware of the problem when these structures are torn down, remodeled, or deconstructed.

Other types of wastes to look out for

- Untreated sewage waste
- Lead-acid batteries
- Used oil
- Tires

Special materials likely to be in C&D loads

C&D debris is especially prone to the following:

Arsenic. Some construction-related material has generated specific attention in recent months. Random tests conducted by the Environmental Working Group in Washington, DC, concluded that the amount of arsenic found on the surface of pressure-treated lumber used widely for decks and play sets exceeds safe levels even after years of wear. On February 12, 2002, lumber companies, in an agreement with EPA, said that after December 2003 they no longer would use chromated copper arsenate (CCA), a powerful pesticide, to protect lumber from decay and insect damage in residential settings. As part of the agreement, EPA said it did not believe there was any reason for people to replace the CCA-treated wood, which is used in an estimated 90% of such outdoor wooden structures as decks, play sets, and picnic tables. EPA is in the process of conducting its own formal risk assessment. CMRA's Turley says, "While there remain questions about how much CCA can be ingested and how it gets into the human body, it is definitely something that is in today's C&D wastestream. In 90% of the country, it is not a problem. Where it is more prevalent, such as Florida, the recyclers there look for it in incoming landfills and get it out of their operations because it will ruin their products. Some does still get through, but tests have shown that when that little bit gets mixed in with the thousands of tons a recycler would be processing anyway, it is below EPA tolerance levels. C&D recyclers need to remain vigilant to keep the material out of their incoming waste."

When working with treated wood, it is recommended that you

- Wear gloves
- Wear a dust mask in the likelihood of exposure to wood-treated sawdust
- Wash exposed parts of your body thoroughly with soap and water after working with treated woods
- If clothes are exposed to sawdust, wash them separately from other laundry.

Asbestos. Asbestos refers to a group of naturally-occurring fibrous minerals that separate into very fine fibers. Asbestos fibers are strong, heat-resistant, and very durable. Asbestos is considered most dangerous when it is crushed, crumbled, or disturbed (occurs especially during remodeling or demolition) because it can release tiny fibers into the air. These fibers remain suspended in the air for a long time and can easily penetrate body tissue after being inhaled or ingested. Inhalation of asbestos fibers can lead to asbestosis (scarring of the lungs), mesothelioma (cancer), and lung cancer.

Because of these serious health risks, building materials containing asbestos must be disposed of according to strict state and federal regulations, which include disposal only in landfills certified by the state or Tribal Department of Environmental Quality (DEQ) to accept asbestos waste. Contractors are liable for failure to follow regulations, procedures, and permitting requirements for containing, hauling, disposing, and keeping records of asbestos waste.

Regulations governing asbestos are the Asbestos Hazard Emergency Response Act (AHERA) and the Clean Air Act Amendments of 1990, which includes federal requirements on handling asbestos found in commercial buildings, schools (K-12), and public institutions. The demolition and/or renovation of structures with asbestos is governed by 10 CFR §61.145.

The primary concern about asbestos-containing material is when it exists in friable form. Friable means that the material can be crumbled or crushed with hand pressure and is therefore likely to emit fibers. Asbestos-containing material existing in nonfriable form and in good (undamaged) condition should present no problems as long as it is left alone and maintained in good condition.

The following are examples of places in a house where asbestos might be found:

- Exterior Surfaces - exterior walls and closed decks built with a fire retardant sheeting that looks like gray cardboard; cement asbestos board (usually light gray in color) used as sheets for straight and lap siding, or shaped to substitute for wood shingles; roof felt or window putty.

- Wall and Ceiling Insulation - loose blown-in and batt insulation (especially in homes built or remodeled between 1930 and 1950) found where interior spaces need to be protected from outside temperatures (such as outside walls and floor or roof/attic spaces between structural joists and rafters).
- Floor Coverings - sheet vinyl (including the backing or underlayment), vinyl tile, and vinyl adhesive.
- Furnaces, Boilers, Heaters, and Piping - insulation blankets (the outside covering or shell), door gaskets, duct insulation, and tape at duct connections of furnaces and boilers; furnaces with asbestos-containing insulation and cement (the material is white or gray in color and resembles plaster) generally installed in older homes between 1920 and 1972; on and inside furnace ducts; insulation or asbestos paper (which looks like corrugated cardboard) around steam and water pipes, particularly at elbows, tees, and valves; cement sheets, millboard, and paper frequently used as thermal insulation for protection of floors and walls around woodstoves.
- Interior Surfaces - sprayed-on or troweled-on surface material on wall and ceiling surfaces; acoustical tiles, textured paint, or heat reflectors (woodstoves).
- Electrical Equipment - materials in older lamp socket collars, electric switch and receptacle boxes, liners for recessed lighting, backing for switchboard panels, fuse boxes, and old-fashioned "knob & tube" wiring.
- Built-in Equipment - oven or dishwasher (in cabinet) units were often wrapped in insulation blankets or sheets until the mid-1970s; water heaters, range hoods, or clothes dryers.
- Appliances - parts with asbestos-containing materials in refrigerators, freezers, portable dishwashers, or ovens.

The above list does not include every material or place in a house that may contain asbestos. More than 3,000 building products contain asbestos. The age of the building is not a valid way to determine the presence of asbestos. Always have suspicious material tested

PCBs. (PCBs) during remodeling or renovation. PCBs were widely used before 1979 as dielectric fluid to insulate electrical equipment such as capacitors, transformers, switches, and voltage regulators, and for fluorescent lamp ballasts. PCBs are considered hazardous because studies have shown them to cause cancer as well as reproductive and developmental defects in laboratory animals. Handling and disposal of materials containing PCBs is regulated by federal and state law.

In the fall of 1993, the EPA received data from several sources indicating that PCBs were found in the insulating (potting) compounds of fluorescent light ballasts generally manufactured prior to 1978 (all ballasts manufactured through approximately 1978 contain PCBs and some manufactured after 1978 contain PCBs as well). Ballasts that contain potting compounds that have 50 ppm or more PCBs (which includes any PCB-containing ballast you will encounter) are termed PCB Articles. PCB Articles must be stored, transported, and disposed of in accordance with Toxic Substances Control Act (TSCA) regulations. Contact an EPA Regional or State Operations Office.

To avoid incurring liability from improperly managed ballasts that have PCB-contaminated potting compounds, the EPA recommends that untested ballasts or ballasts that do not carry a "No PCBs" label should be managed as PCB waste.

PCB is defined as a hazardous substance under CERCLA (Superfund). CERCLA lists one pound as the reportable quantity for PCBs when they are disposed of in a landfill. Each small capacitor in a fluorescent light ballast contains at least 0.1 pounds of pure PCB. So if you are disposing of 10 or more light ballasts, you are subject to CERCLA reporting requirements. Reporting places you on a list of potential Primary Responsible Parties in any subsequent Superfund cleanup of the landfill. For this reason, you can avoid liability by managing ballasts in an alternative manner such as recycling.

EPA has established a policy that recommends against disposing of individual small PCB capacitors, small PCB capacitors contained in fluorescent light ballasts, or untested fluorescent light ballast potting compounds as municipal solid waste. Instead, the EPA encourages you to dispose of non-leaking fluorescent light ballasts and small PCB capacitors at a TSCA-approved facility. These facilities include recyclers, landfills, and incinerators that have EPA approvals to dispose of PCBs.

Ballasts in a lighting system can be punctured or damaged, exposing an oily, tar-like substance (the potting compound). If the leaking ballast is identified as containing PCBs, the ballast and all materials that come in contact with it are fully regulated and are subject to federal PCB requirements.

Should you encounter a leaking ballast containing PCBs, follow these procedures:

- Immediately (within 24 hours) follow detailed spill procedures outlined in 40 CFR, Part 761, Subpart G.
- Leaking ballasts must be disposed of in an EPA-approved PCB incinerator.
- You can transport the leaking ballasts yourself or you can hire a certified hauler. If you transport the ballasts yourself, contact the incinerator first to make sure your ballasts will be accepted. If

you hire a certified hauler, the leaking ballasts must be manifested for shipment. Some haulers are authorized as PCB commercial storers and may be used to arrange for the disposal of ballasts containing PCBs.

Used, nonleaking ballasts may be recycled even if they contain PCBs. Recycling reclaims valuable metals, reduces the volume of solid waste sent to landfills, and prevents toxic substances from being burned in an incinerator or buried in a landfill.

PCBs are regulated by the Toxic Substances Control Act (TSCA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and 40 CFR Part 761--federal regulations governing disposal and liability from improper disposal of PCB-containing materials.

Lead. According to the EPA, approximately three-quarters of the nation's houses built before 1978 (approximately 64 million dwellings) contain some lead-based paint (LBP), although lead-based paint is not used in new residential construction. Lead is also a common component in C&D debris, found in roofs, cornices, tank linings, and electrical conduits. These materials may leach lead into the environment if not properly managed. Soft solder, an alloy of lead and tin, is used in plumbing for soldering joints. Soft solder has been banned from many uses in the United States.

An estimated one in eleven American children have high lead levels in their blood. The Centers for Disease Control (CDC) describes lead poisoning as the most significant, preventable health problem affecting children today. Consumers are suing contractors for lead contamination that occurs during demolition and renovation. You can protect yourself by becoming aware of the hazards of lead poisoning, managing lead-containing demolition debris appropriately, and by examining your liability carefully.

The major source of lead in a home is from contaminated dust (old paint, contaminated soil, and leaded gasoline/auto exhaust residues). Other sources of lead include dust from remodeling and lead in the water from solder or fixtures. Lead-based paint is most commonly found in areas where high durability is needed: windows, doors, door frames, woodwork, and furniture. Lead-based paint is only a hazard if the paint is damaged (peeling, cracking, etc.). The presence of the paint itself is not necessarily a hazard. When disposed, however, material with lead-based paint pose a contamination problem, especially if it gets into the groundwater or surface water. Research has shown that small doses of lead, once thought to be harmless, can cause serious damage to the human body. Young children are at the greatest risk for lead poisoning, which can cause delayed development, reading and learning problems, lowered IQ, hyperactivity, and discipline problems. Larger doses of lead can cause high blood pressure, anemia, and kidney disorders (even in adults).

Lead Paint. EPA estimated that the cost of lead-based paint debris if disposed of as hazardous waste was $316/ton and much less if it was disposed of as municipal solid waste. There was fear that the high cost frustrated lead-based paint removal. To help accelerate the pace of lead-based paint removal from residences, and so reduce exposure to children and adults from the health risks associated with lead, the U.S. EPA issued a change to the definition of "municipal solid waste landfill unit" in both the Criteria for Classification of Solid Waste Disposal Facilities and Practices and the Criteria for Municipal Solid Waste Landfills. In addition, EPA is promulgating two new definitions for "construction and demolition (C&D) landfill" and "residential lead-based paint waste." (federal register, June 18, 2003) This final rule expressly allows residential lead-based paint waste that is exempted from hazardous waste management requirements as household waste to be disposed of in C&D landfills by stating that a construction and demolition landfill accepting residential lead-based paint waste, and no other household waste, is not a municipal solid waste landfill unit. This action does not prevent a municipal solid waste landfill unit from continuing to receive residential lead-based paint waste.

Mercury. Scientific study and recent experience confirm that environmental exposures to mercury, particularly in its highly toxic organic form, methylmercury, can result in harm to human beings and wildlife. Humans are exposed to methylmercury through fish consumption. Although mercury is a naturally-occurring element, the amount of mercury released to the environment has increased since the beginning of the industrial age. Once released, mercury persists in the ambient environment, where it circulates among air, water, sediments, soil, vegetation and wildlife. Most of the mercury sources entering the environment is believed to be the result of air emissions that are transported through the atmosphere and eventually deposited on land and water surfaces. Once mercury enters water, biological processes transform it to a highly toxic form (methylmercury) that builds up in fish and animals that eat fish. Exposure to high levels of mercury has been linked to serious nervous system and developmental problems in humans, especially children.

Mercury-containing devices that can be found in demolished structures include

- Fluorescent lamps
- Mercury lamps
- Metal halide lamps
- High pressure sodium lamps
- Thermostats and thermometers
- Mercury switches and relays

EPA has developed a Safe Mercury Management Program to encourage activities that best support the goals of proper recycling and ensuring safe storage and disposal of mercury wastes and elemental mercury. This program

includes projects that come from stakeholders such as States, the regulated community and environmental organizations, as well as ideas that we have developed while regulating the treatment and disposal of mercury-bearing wastes.

Projects that support the goal of proper mercury disposal include the following:

- Lamp Recycling Outreach Program. EPA has initiated a recycling outreach program for mercury-containing lamps (e.g., fluorescent light bulbs). The program promotes lamp recycling by commercial and industrial users of mercury-containing lamps, and increases awareness of proper disposal methods in compliance with Federal and state Universal Waste rules. The St. Regis Mohawk Tribe is developing lamp education and behavior modification project that will include training workshops and seminars on lamp recycling.

- Mercury Switch and Auto Recycling Program. The automotive industry has used mercury in a variety of applications, including electrical switches for convenience lights and some anti-lock brake systems. Much of the mercury in the more than 215 million mercury switches still in vehicles will be released to the environment when the vehicles are scrapped or recycled, unless programs are in place to remove these mercury switches before final disposal of the vehicles. This project will build on state efforts to remove mercury switches from automobiles and to prevent mercury releases during automobile recycling.

- Universal Waste Rule. The Universal Waste Rule was written in 1995 to streamline environmental regulations for wastes generated by large numbers of businesses in relatively small quantities. It is designed to reduce the amount of hazardous waste disposed of in municipal solid waste, encourage the recycling and proper disposal of certain common hazardous wastes, and reduce the regulatory burden for businesses that generate these wastes. The rule defines Universal Wastes to include batteries, pesticides, thermostats and lamps. In June 2002, EPA proposed to amend its universal waste rules by adding certain mercury-containing equipment as a new universal waste. Mercury is used in several types of instruments that are common to electric utilities, municipalities and certain industries. Some of these devices include switches, barometers, thermometers, temperature gauges, and sprinklers (see Mercury containing products). Note, however, that under this proposal, such devices from households would not be subject to the universal waste standards. EPA is currently addressing comments received on the proposed rule. States can also modify the universal waste

rule and add universal waste in individual state regulations, so check with your state for the exact regulations that apply to you.

SESSION EIGHT

SAFETY

There's no way to discuss safety without acknowledging upfront that collection, disposal, and recycling are potentially dangerous activities, and this applies to C&D collection, disposal, and recycling as well.

"We do believe that it is a high-risk industry–I prefer that to 'dangerous,'" acknowledges James T. Schultz, vice president of health and safety for Waste Management Inc. (WMI) in Houston, TX. "And it is an unforgiving industry. If everyone does everything right, according to the rules, there's no problem. If not–well, as I said, it's unforgiving."

The danger of the profession is well documented, anecdotally and statistically. New York City sanitation workers still remember Mike Hanly, whose face, just before his death, was on a job recruitment poster for the city sanitation department. On November 12, 1996, a container that had been left for pickup and that contained 70% hydrofluoric acid burst under the compactor blade of Hanly's truck. The explosion hit Hanly directly in the face, severely burning him. He died from inhaling the fumes. He was 49. After Hanly's death, sanitation workers consciously tried to stand away from the rear of the vehicle during compaction. A 5K memorial run in Hanly's name has been held annually in Brooklyn to raise funds for his family.

While Hanly's death was particularly well publicized–on the steps of Our Lady of Perpetual Help in Sunset Park bagpipes played and 1,500 sanitation employees placed their hands over their hearts as Hanly's coffin was carried up the church steps–injuries concerning waste collection and disposal are, sadly, too common. On May 7, 1998, two sanitation workers at the Fresh Kills Landfill in Staten Island, NY, became dizzy, delusional, and nauseous. One lost consciousness. The workers were rushed to the local hospital and, on the way, the paramedics attending them became ill. Seven other sanitation workers also were hospitalized for contact with some form of toxic emission. A study by the Agency for Toxic Substances and Disease Registry, released in January 1999, could not determine the cause of the incident--which is perhaps the scariest thing of all: no one knows what the emission was.

On December 1, 1997, the theoretical possibility that recycling aerosol cans could result in an explosion–discussed and debated throughout the 1990s–became a reality. A shipment of aerosol cans containing hairspray opened after being fed into a bale at Joseph Damato Paperstock Recycling Facility in Patterson, NJ. A gaseous cloud developed, was then ignited by a spark from a forklift, and erupted into a ball of fire, killing Darisz Wisniewiski and

severely burning Victor Lopez, the forklift operator. On April 9, 2002, Passaic County, NJ, officials charged two men with aggravated manslaughter in the case, claiming that Joseph Phil Damato accepted the hairspray cans even though the facility was not licensed to dispose of them and that Joseph Frank Damato directed Wisniewiski to compact trash containing the cans. The Criminal Investigation Division of the U.S. EPA has assisted the state prosecution.

For C&D waste, as noted in Session 7, materials that can end up in this waste stream can be especially dangerous. When taking materials from an abandoned house, for example, you don't know what is the materials. Those plastic bottles over there near the stairs. Could it be acid? Could it be ignitable? Approach all material with caution. In collecting C&D debris , follow the example of the New York sanitation workers in the wake of Hanly's death--stand back from the vehicle when the material is placed in any vehicle, especially one with compaction. And this is why the "waste screening" issues described in Session Seven become so important.

Added to these dangers are the dangers that come with operating equipment. John Skinner, executive director of the Solid Waste Association of North America (SWANA) in Silver Spring, MD, puts it concisely: "Safety is a 24-hours-a-day, seven-days-a-week effort, not just a weekly meeting."

Basic Safety Wear

Depending on the situation, the following types of protective wear should be employed:

- Head protection--hard hat, hood
- Eye protection--safety glasses, goggles
- Body protection--aprons, coveralls, protective suits
- Hearing protection--ear plugs, ear muffs
- Foot protection--safety shoes, boots, shoe covers

Tribes should develop a hazards assessment and select protective material accordingly.

Specialized protective wear is available for dealing with particular types of materials such as asbestos.

Equipment Safety

Operating equipment brings up special safety concerns.

Every move made with any piece of equipment must be done with safety in mind. According to the State of California Department of Industrial Relations, the leading cause of non-fatal disabling work injuries involving backhoes, for

example, was simply slipping, falling, or being struck while getting on and off the machine.

The U.S. Bureau of Labor Statistics estimates a high number--higher than other occupations--of fatalities in the refuse industry due to employees being struck by vehicles and a high number of non-fatal injuries due to employees striking or being struck by or being compressed in equipment.

Those who operate equipment must be aware of all possible dangers at all times and do everything they can to reduce the risk of injury or accident. Many of accidents occur because the operator fails to follow very basic rules.

- Be thoroughly familiar with all basic machine controls, levers, pedals, switches, and gauges. Test drive the machine to familiarize yourself with the controls and its "feel."

- Check the owner's manual to review physical dimensions of the machine, rules regarding warning signs. Pay attention and concentrate on what you are doing. Your visual range could be limited by the equipment itself. This plus the noise of the equipment can isolate the operator from what is going on around him or her.

- Be aware of all persons and activity in your work area. If you are not the operator, make sure the operator is aware of you.

- Recognize potentially dangerous situations.

- Maintain a high level of safety awareness at all times.

- Never operate equipment in any situation you feel may be dangerous.

- Treat the machine as if it can turn on you at any time. Never turn your back on equipment. Place chocks or blocks in front of a vehicles wheels to prevent it from rolling when the equipment is idling and after you shut off the engine.

- Whenever you are in doubt about safety, stop doing what you are doing.

- If danger develops in the middle of a job, stay calm and think yourself through the situation. The earlier danger is recognized the easier it can be avoided. If you transport vehicle becomes stuck, for example, don't sit there and let the wheels spin. Get off, walk around the machine, and find out where the weight is, how it is distributed, and how it should be distributed.

- Look out for workers on the job who aren't looking out for themselves.

Atmospheric Monitoring

Atmospheric Monitoring of the work environment can become critical in protecting the safety of all who may be working or overseeing the landfill operations. The release of gaseous by-products due to the decomposition of the landfill's organic materials can produce gases that can subject workers to a number of ailments that can range from minor irritations of mucus membranes to possible asphyxiation.
Construction and Demolition landfill gas composition consist largely of hydrogen sulfide, methane, carbon dioxide, nitrogen, and oxygen. There are a number of trace gases produced at these sites and a partial list is provided in the appendix. Landfill gas volume rises steadily during a landfill years of operation and the peak gas volume produced occurs between year 16 and year 24. After this period, the gas volume produced gradually declines . This discussion will focus primarily on those gases which are believed to be the greatest health threat to site workers.

Hydrogen Sulfide (H2S) is an extremely toxic gas with a low odor threshold and a pungent odor. This gas also has flammability hazard with a flammable range of 4%(lower explosive limit) to 44%(upper explosive limit).The National Fire Protection Association(NFPA) has assigned hydrogen sulfide its highest health and flammability hazard code rating of 4. The vapor density of H2S is greater than air which means it may accumulate in low lying areas and may travel a considerable distance to an ignition source.

With the disposal of gypsum wallboard in C&D landfills, there is potential for producing hydrogen sulfide gas. Hydrogen sulfide is a toxic and explosive gas produced by the anaerobic decomposition of sulfur compounds by bacteria. Landfills often have the appropriate conditions (moisture, anaerobic conditions, temperature, pH, etc.) to produce hydrogen sulfide from gypsum wallboard decomposition. (excerpted from John Reindl's Bibliography on Gypsum Drywall and reference number 59 - "Treatment and Disposal of Gypsum Board Waste.Technical Paper. Part II", Construction Dimensions, March 1992, pages58-63).

Some health related facts associated with this toxic gas:

- At low concentrations, 0.13 - 10 ppm, we can smell it as the rotten egg odor;

- At about 100 ppm, we lose the ability to smell it, coughing and eye irritation;
- 200 - 300 ppm, eye inflammation and respiratory tract irritation
- within one hour of exposure;
- 500 -700 ppm, loss of consciousness and death in 0.5 - 1.0 hour of exposure;
- 1000 -2000 ppm cessation of respiratory function within a few
- minutes.

H2S is a serious problem once it is being generated. Landfill gas monitoring of low lying areas in and around the landfill should be conducted to ensure safe conditions. Site workers should never try to sniff vents for odors and should always approach vents from an upwind direction for monitoring. In some cases the landfill workers may detect early warning signs of possible H2S problems if they are coughing and/or have inflamed eyes. The MSDS sheet for H2S should be consulted for additional safety information.

Landfills are the largest man-made source of methane gas in the United States. While landfill produced methane has great benefits as a cheaper form of natural gas, a healthy respect must be maintained for methane. Methane is a simple asphyxiant and is extremely flammable. This gas also has a high flammability hazard with a flammable range of 5%(lower explosive limit) to 15% (upper explosive limit).The National Fire Protection Association(NFPA) has assigned methane gas its highest flammability hazard code rating of 4. However, this narrow flammability range makes it a relatively safe gas for use as compared to gases like hydrogen.(Hydrogen has flammability range of 2% to 75%) Methane is a simple asphyxiant and environments where the oxygen level has dropped below 19.5%, will required a self contained breathing apparatus (SCBA) or a respirator with supplied air to enter.

Detection of these potentially harmful gases can be best identified and quantified by the use of a direct reading instrument. They are the primary tools of initial site characterization. The information provided by direct-reading instruments can be used to institute appropriate protective measures. There are a number of combustible gas indicators on the market that are perfectly suited for this application. The standard instruments will measure %Oxygen ,%LEL and % Toxicology. Many brands allow for additional measurements and the %H2S will be a suggested addition.

Direct- reading colorimetric tubes can also be used to monitor landfill sites. The cost of this type of measurement is relatively inexpensive but the accuracy is only +/- 25%. The tubes can also only detect one specific gas or vapor and this will limit their effectiveness.

If trace organics are a concern, the HNU instrument is an excellent choice for detecting total organics and some inorganics and vapors. The HNU instruments are subject to some interferences from mixed gases and they will not detect methane.

Personal protective equipment (PPE) may be necessary to protect site workers from the inhalation of the toxic chemicals that can be emitted from C&D landfills. If site workers are to be equipped with respiratory protection equipment, a respiratory protection program must be instituted that will comply with the OSHA standard 29CFR1910.134 . The standard includes fit testing which must be done on annual basis. Chemical resistant clothing is another aspect of PPE that must be evaluated for landfill site workers. The level of protection should be based on the 1) the type and measured concentrations of the chemical substances in the ambient atmosphere and the associated toxicity and 2) the potential for personnel to be exposed to hazardous substances in air. In situations where the type of chemicals, the concentrations and the possibilities of contact are unknown, the appropriate level of protection must be based professional experience and judgment. The appropriate level of protection can be reassessed as the hazard(s) become better identified.

Glossary

Baler Compresses material into dense rectangular bales which are tied with wire. (vertical, horizontal, two-ram)

Brown goods Electronic equipment such as computers, printers, televisions, etc.

C&D Construction and demolition debris.

CESQC Conditionally exempt small quantity generator. Businesses that generate hazardous wastes in such small quantities they are exempt from certain disposal regulations.

Closed-loop recycling Recycling materials into their original form, such as using glass cullet to make new bottles rather than incorporating it into asphalt.

Compactor 10- to 40-cubic-yard closed containers in which debris is compressed to save space. There are two types: the break-away, in which the hydraulic compacting ram and container unit are separate pieces of equipment; and the self-contained, where the ram and container are

Dumpster The trademarked name of a 2-, 3-, 4-, 6- or 8-cubic-yard commercial garbage container commonly made of steel (sometimes aluminum), with a plastic lid, serviced with a front end loader truck

Front End Loader A commercial solid waste collection truck equipped with two hydraulic forks used to pick up and empty Dumpsters from the front.

Generator A sector, such as residential or commercial, responsible for producing waste or recyclables.