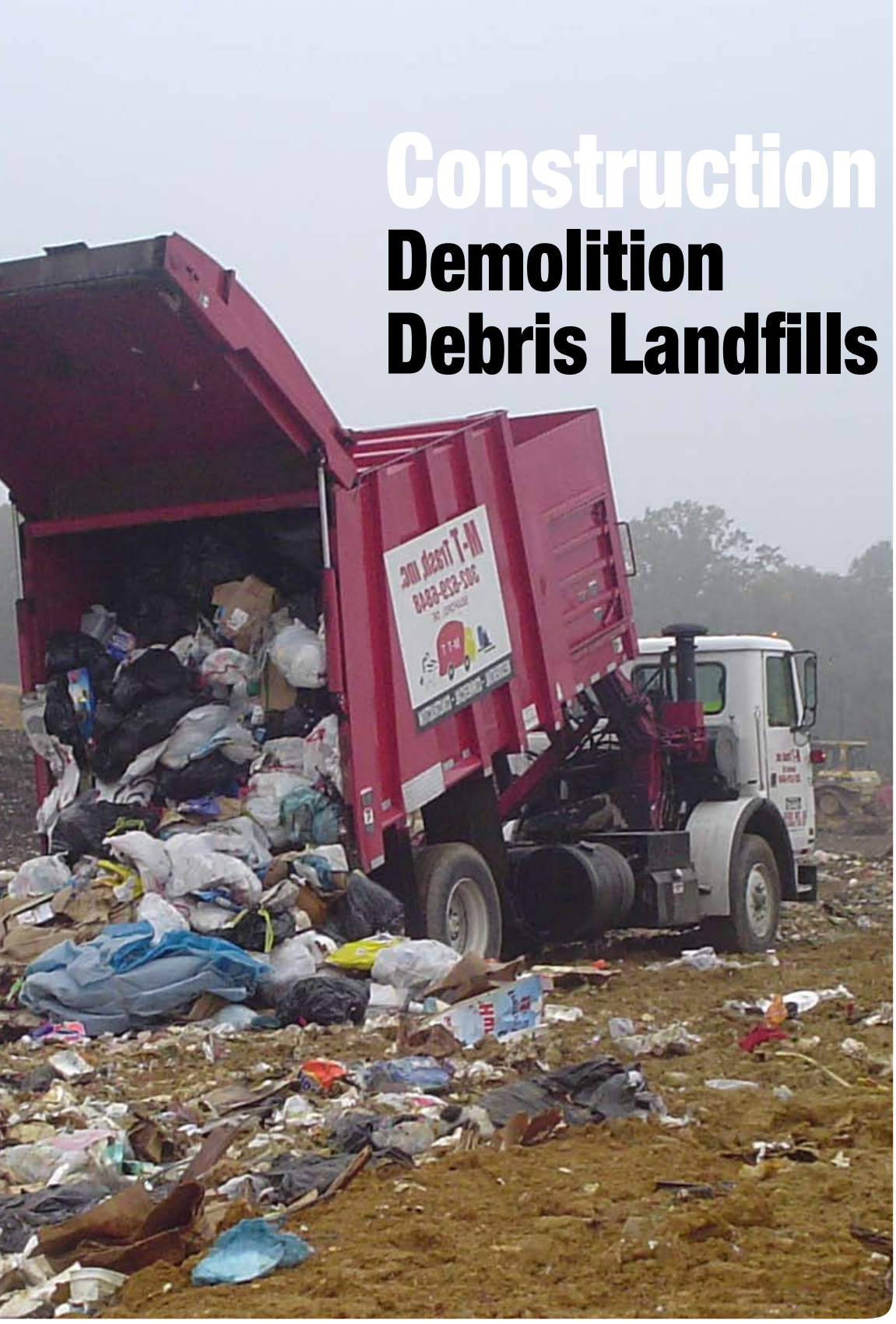
Construction & Demolition Debris Landfills



FactPack – P042

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Construction & Demolition Debris Landfills

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FactPack - PUB 042

Updated August 2020

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Mentoring a Movement

Empowering People

Preventing Harm

About the Center for Health, Environment & Justice

CHEJ mentors a movement building healthier communities by empowering people to prevent harm caused by chemical and toxic threats. We accomplish our work through programs focusing on different types of environmental health threats. CHEJ also works with communities to empower groups by providing the tools, direction, and encouragement they need to advocate for human health, to prevent harm and to work towards environmental integrity.

Following her successful effort to prevent further harm for families living in contaminated Love Canal, Lois Gibbs founded CHEJ in 1981 to continue the journey. To date, CHEJ has assisted over 15,000 groups nationwide. Details on CHEJ's efforts to help families and communities prevent harm can be found on www.chej.org.

Introduction

The Center for Health, Environment and Justice has developed this fact pack on Construction and Demolition Debris Landfills in response to the numerous requests for information that we have had on this topic. This fact pack includes three types of information:

- Selections from technical papers describing the chemicals typically found in C&D landfills
- News clips describing community struggles to address problems posed by C&D landfills
- Programs in place to address the reuse and recycling of much of the waste that typically goes into a C&D landfill

We have included materials from nonprofit organizations, government agencies, consulting companies, newspapers, and journals in an effort to provide a thorough introduction to the issues. We have included the executive summary of several technical reports that highlight what we believe is important information. The full text of these reports can be found on the web sites listed on this information.

We intend this fact pack to be a tool to assist you in educating yourself and others. We do not endorse the conclusions of the government and consulting reports in this fact-pack. We've included them because they provide valuable information describing the kinds of chemicals typically found in C&D landfills and how these landfill impact the surrounding community.

Our hope is that reading this fact pack will be the first step in the process of empowering your community to protect itself from environmental health threats. CHEJ can help with this process. Through experience, we've learned that there are four basic steps you'll need to take:

1. Form a democratic organization that is open to everyone in the community facing the problem.

2. Define your organizational goals and objectives.

3. Identify who can give you what you need to achieve your goals and objectives. Who has the power to shut down the landfill? Do a health study? Get more testing done? It might be the head of the state regulating agency, city council members, or other elected officials.

4. Develop strategies that focus your activities on the decision makers, the people or person who has the power to give you what you are asking for.

CHEJ can help with each of these steps. Our mission is to help communities join together to achieve their goals. We can provide guidance on forming a group, mobilizing a community, defining a strategic plan, and making your case through the media. We can refer you to other groups that are fighting the same problems and can provide technical assistance to help you understand scientific and engineering data and show you how you can use this information to help achieve your goals.

If you want to protect yourself, your family, and your community, you need information, but equally important is the need to organize your community efforts.

Thank you for contacting us.

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Businesses and Recycling of Debris Waste

CONSTRUCTION AND DEMOLITION WASTE LANDFILLS

Prepared for

U.S. Environmental Protection Agency
Office of Solid Waste

by

ICF Incorporated
Contract No. 68-W3-0008

February 1995

*** May 18, 1995 Draft Report ***

EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) is currently developing a rule addressing non-municipal facilities (industrial waste facilities, including construction and demolition waste landfills) that may receive hazardous wastes from conditionally exempt small quantity generators (CESQGs), or generators of less than 100 kilograms per month of hazardous waste. This report, prepared in support of EPA's rulemaking, presents information on construction and demolition (C&D) waste landfills, i.e., landfills that receive materials generated from the construction or destruction of structures such as buildings, roads, and bridges. C&D waste landfills are being examined because the Agency believes that the largest potential impact from this rulemaking will be on these facilities.

BACKGROUND

The 1984 Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA) required EPA to revise the existing standards and guidelines governing the management of household hazardous wastes and hazardous wastes from small quantity generators. EPA responded in 1991 by revising the existing criteria for solid waste disposal facilities and practices (40 CFR Part 257). In 1991 EPA issued revised criteria in 40 CFR Part 258 for municipal solid waste landfills (MSWLFs) that receive household hazardous wastes and CESQG wastes. EPA did not establish revised criteria for non-municipal facilities and subsequently was sued by the Sierra Club. A consent agreement was reached in January 1994, and EPA is now fulfilling the remainder of the HSWA mandate by regulating non-municipal facilities that may receive CESQG wastes. The final rule must be signed by the EPA Administrator by May 15, 1995. The rule will require facilities receiving CESQG wastes to have adequate ground-water monitoring, corrective action requirements, and location restrictions.

COMPOSITION OF C&D WASTE

Information on the composition of C&D waste is presented below. Most of this information was compiled from the literature by the National Association of Demolition Contractors (NADC); a small number of other readily available sources were used as well. These source documents provide only snapshots of the C&D waste stream in specific locations and at specific points (e.g., generation) rather than providing a complete cradle-to-grave picture of C&D wastes nationwide, or of the portion landfilled.

C&D waste is generated from the construction, renovation, repair, and demolition of structures such as residential and commercial buildings, roads, and bridges. The composition of C&D waste varies for these different activities and structures. Overall, C&D waste is composed mainly of wood products, asphalt, drywall, and masonry; other components often present in significant quantities include metals, plastics, earth, shingles, insulation, and paper and cardboard.

C&D debris also contains wastes that may be hazardous. The source documents identify a number of wastes that are referred to using such terms as "hazardous," "excluded," "unacceptable," "problem," "potentially toxic," or "illegal." It is not necessarily true that all of these wastes meet the definition of "hazardous" under Subtitle C of RCRA, but they provide an indication of the types of hazardous wastes that may be present in the C&D waste stream. They can be divided into four categories:

- Excess materials used in construction, and their containers. *Examples: adhesives and adhesive containers, leftover paint and paint containers, excess roofing cement and roofing cement cans;*
- Waste oils, grease, and fluids. *Examples: machinery lubricants, brake fluid, form oil, engine oil;*
- Other discrete items. *Examples: batteries, fluorescent bulbs, appliances;* and
- Inseparable constituents of bulk items. *Examples: formaldehyde present in carpet, treated or coated wood.*

Some of these components are excluded from C&D landfills by state regulations.

C&D LANDFILL LEACHATE QUALITY

Construction and demolition landfill leachate sampling data were collected from states and from the general literature by NADC. Leachate sampling data for 305 parameters sampled for at one or more of 21 C&D landfills were compiled into a database.

Of the 305 parameters sampled for, 93 were detected at least once. The highest detected concentrations of these parameters were compared to regulatory or health-based "benchmarks," or concern levels, identified for each parameter. Safe Drinking Water Act Maximum Contaminant Levels (MCLs) or Secondary Maximum Contaminant Levels (SMCLs) were used as the benchmarks if available. Otherwise, health-based benchmarks for a leachate ingestion scenario were identified; these were either reference doses (RfDs) for non-carcinogens, or 10^{-6} risk-specific doses (RSDs) for carcinogens. Benchmarks were unavailable for many parameters because they have not been studied sufficiently.

Of the 93 parameters detected in C&D landfill leachate, 24 had at least one measured value above the regulatory or health-based benchmark.[1] For each of the parameters exceeding benchmarks (except pH), the median leachate concentration was calculated and compared to its benchmark. The median value was first calculated among the samples taken at each landfill, and then across all landfills at which the parameter was detected. Due to anomalies and inconsistencies among the sampling equipment used at different times and at different landfills, non-detects were not considered in determining median values; i.e., the non-detects were discarded before calculating both individual landfill concentration medians and medians across landfills. Thus, the median leachate concentrations represent the median among the detected values, rather than the median among all values. The median concentration among all values would in most cases have been lower than those calculated here.

Based on (1) the number of landfills at which the benchmark was exceeded and (2) a comparison between the median detected concentration and the benchmark, seven constituents emerge as being potentially problematic. They are listed in the table below. Also shown are the number of landfills at which the constituent was sampled, the

C&D LANDFILL LEACHATE - POTENTIALLY PROBLEMATIC CONSTITUENTS

Constituent	No. Landfills Sampled	No. Landfills Detected	No. Landfills > Benchmark	Ratio of Median to Benchmark
1,2-Dichloroethane	9	3	3	4
Methylene chloride	9	4	3	3
Cadmium	19	14	12	2
Iron	20	20	19	37
Lead	18	15	13	4
Manganese	14	14	13	59
Total dissolved solids	18	17	15	4

[1] In the case of pH, the "exceedances" were actually pH values below the regulatory range.

number of landfills at which the constituent was detected, the number of landfills at which the constituent was detected above its benchmark, and the ratio of the median detected concentration to the benchmark.

For three of the seven parameters listed in the table (iron, manganese, and TDS), the benchmarks are secondary MCLs (SMCLs), which are set to protect water supplies for aesthetic reasons (e.g., taste) rather than for health-based reasons. None of the remaining four parameters exceeds its benchmark by a factor of 10 or more, indicating that concentrations in ground water where monitoring wells or drinking water wells may be located are likely to fall below the health-based benchmarks.

Conclusions regarding C&D landfill leachate quality must be viewed with an understanding of the data limitations. The most important limitation is that the 21 landfills represented in this report comprise just over one percent of the approximately 1,800 C&D landfills in the United States. Thus, the representativeness of the sample is questionable. Other limitations are discussed in the body of the report.

STATE REGULATIONS

State statutes and regulations for C&D landfills were summarized, and similarities and differences between current state requirements for C&D landfills and federal requirements for MSWLFs were evaluated. The following summarizes the key findings:

- **All states regulate off-site C&D landfills to some extent.** Thirteen states require off-site C&D landfills to meet state MSWLF requirements (in many states, these requirements are not as stringent as the federal MSWLF requirements found in 40 CFR Part 258), while the remaining 37 have developed separate regulations that are specific to off-site C&D landfills.[2]

- **Only seven states exempt on-site C&D landfills from regulatory requirements.** Of the remaining 43 states, 11 require on-site C&D landfills to meet state sanitary landfill requirements (in many states, these requirements are not as stringent as 40 CFR Part 258), 8 have developed separate regulations applicable to only on-site landfills, and the remaining 24 have extended the regulations for off-site landfills to on-site landfills.

- **Sixteen states mandate location restrictions, ground-water monitoring, and corrective action for off-site C&D landfills.** These requirements, however, vary in stringency relative to 40 CFR Part 258. For example, **only two states have location restrictions, ground-water monitoring, and corrective action requirements for off-site C&D landfills that are at least as stringent as 40 CFR Part 258.**

- **The most common 40 CFR Part 258 location restrictions that states apply to C&D landfills relate to: airports and bird hazards, wetlands, and floodplains.** Several states have moved beyond federal requirements and prohibit the siting of on-site (eight states) and off-site (nine states) C&D landfills in floodplains. Fewer states have adopted the 40 CFR Part 258 requirements regarding faults, seismic zones, and unstable areas.

- **A majority of states impose additional location restrictions on C&D landfills.** The most common additional restrictions are: near ground and surface waters, and near endangered species habitats.

- **Twenty-nine states (nearly 60 percent) require off-site C&D landfills to monitor ground water.** Of these 29 states, 5 have requirements substantially similar to 40 CFR Part 258, while 24

[2]Ohio expects to have specific C&D management requirements effective by the end of 1995.

have requirements that are less stringent.[3] **The remaining 21 states do not require ground-water monitoring requirements.** Of these 21, however, 12 "may" require ground-water monitoring if the regulatory authority deems it necessary.

- **Twenty-four states (nearly 50 percent) require on-site C&D landfills to monitor ground water.** Of these 24, only 4 have requirements substantially similar to 40 CFR Part 258, while 20 have requirements that are less stringent. **The remaining 26 states do not require ground-water monitoring.** Of these 26, 9 states "may" require ground-water monitoring if the regulatory authority deems it necessary.

- **Twenty-two states have corrective action requirements for off-site C&D landfills.** These states either require the permit applicant to submit a corrective action plan with the permit application, or require the facility owner/operator to submit a plan after a release to ground water is detected.

- **Sixteen states have corrective action requirements for on-site C&D landfills.** Again, these states either require the permit applicant to submit a corrective action plan with the permit application, or require the facility owner/operator to submit a plan after a release to ground water is detected.

- **States also have mandated permit, design and operating, post-closure, and financial assurance requirements for both on-site and off-site C&D landfills.** The most common of these is permitting requirements. Respectively, 45 and 38 states require off-site and on-site C&D landfills to obtain a permit.[4] Thirty-four states require some post-closure time period for off-site landfills (11 require at least 30 years and 23 require less than 30 years). Additionally, 33 states require off-site C&D landfills to obtain financial assurance for closure, while 32 require it for post-closure care.

- **Twenty-four states prohibit all hazardous wastes from disposal at off-site C&D landfills.** In addition, three and four states require that only inert waste and C&D waste be disposed, respectively. Fourteen states do not specifically prohibit disposal of all hazardous wastes at off-site C&D landfills. In general, the regulations for these states note that only waste specified in permit may be accepted, or only "regulated" or "controlled" hazardous waste is prohibited. Finally, five states do not specifically identify any restrictions on waste disposal at off-site C&D landfills.

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[3]Ohio currently does not have ground-water monitoring, but monitoring is expected to be part of C&D management regulations that should be finalized by the end of 1995.

[4]Ohio requires a permit for C&D landfills.

TABLE 2-1
COMPONENTS OF C&D WASTE

ASPHALT paving shingles	**PAINT** **paint containers and waste** **paint products**	**WALL COVERINGS** **drywall (gypsum)** plaster
EARTH dirt sand, foundry soil	**PAPER PRODUCTS** cardboard fiberboard, paperboard paper	**WOOD** cabinets composites millends pallets, shipping skids, and crating lumber particle board plywood siding trees: limbs, brush, stumps, and tops veneer
ELECTRICAL fixtures wiring	**PETROLEUM PRODUCTS** **brake fluid** **form oil** **fuel tanks** **oil filters** **petroleum distillates** **waste oils and greases**	**WOOD CONTAMINANTS** **adhesives and resins** **laminates** **paintings and coatings** **preservatives** **stains/varnishes** **other chemical additives**
INSULATION **asbestos** building extruded polystyrene (rigid) **fiberglass (bat)** roofing	**PLASTICS** buckets pipe (PVC) polyethylene sheets styrofoam sheeting or bags laminate	**MISCELLANEOUS** **adhesives and adhesive cansaerosol cans** **air conditioning units** **appliances ("white goods")** **batteries** **carpeting** **caulk (tubes)** ceiling tiles **driveway sealants (buckets)** **epoxy containers** **fiberglass** fines fireproofing products (overspray) floor tiles **furniture** **garbage** glass **lacquer thinners** leather **light bulbs, fluorescent and HID** light bulbs, other linoleum organic material packaging, foam **pesticide containers** rubber **sealers and sealer tubes** sheathing silicon containers **solvent containers and waste** street sweepings textiles **thermostat switches** **tires** **transformers** water treatment plant lime sludge
MASONRY AND RUBBLE bricks cinder blocks concrete mortar, excess porcelain rock stone tile	**ROOF MATERIALS** **asbestos shingles** roofing, built up **roofing cement cans** roofing shingles roofing tar tar paper	
METAL aluminum (cans, ducts, siding) brass fixtures, plumbing flashing gutters **mercury from electrical switches** iron **lead** nails pipe (steel, copper) sheet metal steel (structural, banding, decking, rerod) studs, metal wire (e.g., copper)	**VINYL** siding flooring doors windows	

Source: Summarized from NADC, 1994a and 1994b; Hanrahan, 1994; and Lambert and Domizio, 1993.

TABLE 2-5
AMOUNT OF CHEMICAL CONSTITUENTS IN WOOD PRODUCTS
(Source: ERL, 1992)

Wood Product	Chemical Constituent	Amount of Chemical(s) in Wood Product	Note
pallets and skids, (hardwood/softwood)	pentachlorophenol lindane dimethyl phthalate copper-8-quinolinolate copper naphthenate	< 10 ppm	a
pallets, plywood	phenolic resins	2-4%	a
pallets, glued	epoxy	2-4%	
painted wood, lead-based paint	lead	1400-20,000 ppm (before 1950)	b
painted wood, acrylic-based paint	acrylic acid, styrene, vinyl toluene, nitriles	<0.01%	
painted wood, "metallic" pigments	aluminum powder, copper acetate, phenyl mercuric acetate, zinc chromate, titanium dioxide, copper ferrocyanide	<0.01%	
plywood, interior grade	urea formaldehyde (UF) resins	2-4%	c
plywood, exterior grade	phenol formaldehyde (PF) resins	2-4%	c
oriented strandboard	phenol formaldehyde resins, or PF/isocyanate resins	2-4%	
waterboard "Aspenite"	urea formaldehyde resins or phenolic resins	5-15% UF 2.5% PF, 2% wax	d
overlay panels	phenol formaldehyde resins	4-8%, sometimes up to 10%	
plywood/PVC laminate	urea formaldehyde polyvinyl chloride	2.5% UF 10% PVC	
particleboard	urea formaldehyde resins	5-15% UF	d
particleboard with PVC laminate	UF resins with polyvinyl chloride	4.5% UF 10% PVC	
hardboard	phenolic resins	1.5%	
fencing and decks: pressure treated southern pine	CCA or ACA	1-3%	e
fencing and decks: surface treated	CCA or ACA	1-3%	e
utility poles, laminated beams, freshwater pilings, bridge timbers, decking, fencing	pentachlorophenol	1.2-1.5%	f

Wood Product	Chemical Constituent	Amount of Chemical(s) in Wood Product	Note
railroad ties, utility poles	creosote containing 85% PAHs	14-20%	g
freshwater pilings, docks	creosote - coal tar	15-20%	
marine pilings, docks	creosote/chlorpyrifos	15-20%	

a Hardwood pallets are used primarily in the eastern U.S.; softwood and plywood pallets are used primarily in the western U.S.
b Lead level is highly dependent on the age of the paint; before 1950 lead comprised as much as 50% of the paint film. Legislation in 1976 reduced standard to 0.06% by weight.
c Plywood may be surface-coated with fire retardants, preservatives and insecticides, or pressure-treated with CCA.
d May be sealed with polyurethane or other sealant to prevent offgassing of formaldehyde.
e Dominant wood preservative; actual levels will be lower due to evaporation or leaching after treatment.
f Restricted use due to industry change and concern over dioxin linkage; not permitted for residential uses.
g Losses after treatment estimated to be 20-50% over 10-25 years; not recommended for residential use.

Overall, C&D waste streams are comprised mainly of wood products, asphalt, drywall, and masonry. Other notable components include metals, plastics, earth, shingles, and insulation. Most of the source documents did not provide information on the percentage of C&D waste that is "hazardous." Those that did indicated that "hazardous" waste comprised a small percentage of the total C&D waste stream (e.g., 0.4 percent of construction waste in one county in North Carolina). The source documents did not define "hazardous" or other "problematic" wastes as wastes that are classified as hazardous under RCRA Subtitle C.

The source documents did note that although C&D wastes have traditionally been considered inert and harmless, they have become an issue of concern in the 1990s. This is largely because some C&D wastes that were previously considered harmless are now considered to be "toxic" or to contain "hazardous" materials, such as wood that is coated with lead paint (Piasecki et al., 1990; Lambert and Domizio, 1993). "Problematic" wastes cited by three or more of the reports or articles in the source documents are: adhesives, caulk, paint, wood preservatives, formaldehyde resins, stains and varnishes, appliances, batteries, mercury-containing switches and lights, PCB-containing transformers and capacitors. Again, these "problematic" wastes may or may not qualify as hazardous wastes under RCRA Subtitle C. More attention has also focused on C&D landfills because they may be used to dump hazardous wastes illegally (Piasecki et al., 1990; Lambert and Domizio, 1993).

Construction and Demolition (C&D) Debris Landfills

General Description

Landfills where PCBs are disposed because they are designed such that protection against risk of injury to health or the environment from mitigation of PCBs to land, water, or the atmosphere is provided from PCBs and PCB Items deposited therein by locating, engineering, and operating the landfill as required.

Summary of Federal Requirements

Although federally defined, there are no Federal regulations unique to C&D landfills.

- Construction and Demolition (C&D) Landfill - a solid waste disposal facility subject to the requirements in 40 CFR 257, subparts A or B that receives construction and demolition waste and does not receive hazardous waste (defined in 40 CFR 261.3) or industrial solid waste (defined in 40 CFR 258.2). Only a C&D landfill that meets the requirements of 40 CFR 257, subpart B may receive conditionally exempt small quantity generator waste (defined in 40 CFR 261.5 of this chapter). A C&D landfill typically receives any one or more of the following types of solid wastes: roadwork material, excavated material, demolition waste, construction/renovation waste, and site clearance waste (40 CFR 258.2).

- Construction and Demolition Wastes - the waste building materials, packaging, and rubble resulting from the construction, renovation, repair, and demolition operation on pavements, houses, commercial buildings, and other structures (40 CFR 243.101).

Summary of State Requirements

This classification of landfill is uniquely a state-regulated issue. More and more the push is to reduce the amount of C&D waste by optimally recycling the construction debris.

Laws and Statutes

Clean Air Act

DAMAGE CASES:

CONSTRUCTION AND DEMOLITION WASTE LANDFILLS

Prepared for

U.S. Environmental Protection Agency
Office of Solid Waste

by

ICF Incorporated
Contract No. 68-W3-0008

January 1995

*** May 18, 1995 Draft Document ***

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EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) is currently developing a rule addressing non-municipal facilities (industrial waste facilities, including construction and demolition waste landfills) that may receive hazardous wastes from conditionally exempt small quantity generators (CESQGs), or generators of less than 100 kilograms per month of hazardous waste. This report, prepared in support of EPA's rulemaking, presents information on environmental damages from construction and demolition (C&D) waste landfills, i.e., landfills that receive materials generated from the construction or destruction of structures such as buildings, roads, and bridges. C&D waste landfills are being examined because the Agency believes that the largest potential impact from this rulemaking will be on these facilities.

BACKGROUND

The 1984 Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA) required EPA to revise the existing standards and guidelines governing the management of household hazardous wastes and hazardous wastes from small quantity generators. EPA responded in 1991 by revising the existing criteria for solid waste disposal facilities and practices (40 CFR Part 257). In 1991 EPA issued revised criteria in 40 CFR Part 258 for municipal solid waste landfills (MSWLFs) that receive household hazardous wastes and CESQG wastes. EPA did not establish revised criteria for non-municipal facilities and subsequently was sued by the Sierra Club. A consent agreement was reached in January 1994, and EPA is now fulfilling the remainder of the HSWA mandate by regulating CESQG wastes that are disposed in non-municipal facilities. The final rule must be signed by the EPA Administrator by May 15, 1995. The rule will require facilities receiving CESQG wastes to have adequate ground-water monitoring, corrective action requirements, and location restrictions.

PURPOSE OF THIS REPORT

The purposes of this study were to (1) determine whether the disposal of C&D waste in landfills has led to contamination of ground water or surface water, or damages of ecological resources, and (2) examine whether these environmental damages can be attributed to specific aspects of the site such as the types of waste received, design and operating practices, and environmental setting/location.

METHODOLOGY

To compile documentation of environmental impacts resulting from C&D waste landfills, EPA searched for sites that met the following criteria:

- The landfill received predominantly C&D waste, with or without CESQG waste mixed in. Landfills that were known to have received significant quantities of municipal, industrial, or hazardous wastes were excluded.
- The use of the site as a C&D landfill had to be the only potential source of the observed contamination. Sites located near other potential sources of the contamination such as underground storage tanks were excluded.
- There had to be documented evidence of ground-water contamination, surface water contamination, or ecological damage at the site. "Contamination" was defined as an increase in constituent levels above background, or an exceedance of an applicable regulatory standard or criterion attributable to releases from the site.

EPA searched for sites meeting these criteria using four information sources:

- *Existing studies of C&D waste landfills.* Two studies provided particularly useful background information: (1) *Construction and Demolition Debris Disposal Issues: An Alachua County Perspective* (Hanrahan, 1994); and (2) *Construction and Demolition Waste Disposal: Management Problems and Alternative Solutions* (Lambert and Domizio, 1993).

- *Materials available through the Superfund program.* Superfund databases were searched to identify C&D waste landfills on the National Priorities List or under investigation. None of the Superfund sites were found to be appropriate damages cases, typically because they received a wide variety of wastes in addition to C&D waste.

- *Representatives of EPA Regions* were contacted. Because C&D waste landfills are regulated by the states rather than EPA, the representatives provided lists of state contacts.

- *Representatives of state and county environmental agencies* were contacted in 32 states. Only three states -- New York, Virginia, and Wisconsin -- clearly identified C&D waste landfills that met the criteria listed above. These states allowed EPA to review documentation on potential damage cases to obtain more detail on the cases reported here. Documentation reviewed included preliminary site assessments for New York sites, C&D site background files and monitoring data for Virginia sites, and a ground-water impact investigation for Wisconsin sites.

RESULTS

Only 11 damage cases were identified using the above methodology. All 11 sites reported ground-water contamination within the property boundary; none reported ground-water contamination off site. This does not mean that there was no off-site ground-water contamination; in most cases, ground-water monitoring was not performed beyond the site boundary.

Although most of the sites monitored ground water for a wide range of organic and inorganic constituents, virtually all of the contamination was associated with inorganics. Constituents that exceeded state ground-water protection standards or federal drinking water criteria most frequently were iron, manganese, total dissolved solids (TDS), and lead. Two of these constituents -- iron and manganese -- were found to exceed applicable standards by a factor of 100 or more in at least one sample at many landfills (i.e., at 5 of the 11 sites for iron, and at 4 of the 11 sites for manganese). It is noteworthy that for both constituents, the standard that was exceeded is a secondary, rather than primary, drinking water standard (MCL). Secondary MCLs are set to protect the water supply for aesthetic (e.g., taste) rather than health-based reasons.

Six sites had surface water contamination; three of these sites also had some contamination of sediments. At two sites, the surface water and sediment contamination was off site as well as on site. As with ground water, most of the contamination was associated with inorganic constituents. Constituents that exceeded state surface water standards or EPA's Ambient Water Quality Criteria (AWQC) for the protection of freshwater aquatic life most frequently were iron, zinc, lead, copper, and acidity (pH). Two of the sites reporting contamination of sediments had elevated levels of polynuclear aromatic hydrocarbons (PNAs).

The source documents rarely examined the possible link between environmental damages observed at a site and the design, operating, or location attributes of the site. Factors that might have contributed to the damages at the 11 sites are as follows:

- Seven landfills contained other types of wastes that had been disposed of legally or illegally, including tires, household hazardous wastes, and other materials.

- Environmental controls were typically inadequate or absent. Only two landfills were equipped with partial bottom liners and leachate collection systems (LCSs). Run-on and/or run-off controls were mentioned for only three sites. Six sites apparently had some type of final cover, but only two had more than a thin soil cover. For four sites, no environmental controls were mentioned in the source documents.

- Many of the landfills are characterized by environmental settings that could facilitate the release and transport of contaminants, including shallow ground water, complex ground-water flow conditions, and highly permeable subsoils. Many landfills had ponds, streams, or wetlands either on site or within close proximity; one site was located in a 100-year floodplain.

Although this study demonstrates that specific C&D waste landfills can lead to ground-water and surface water contamination, the Agency believes that it has insufficient data, at this point, to require more than the statute requires (i.e., ground-water monitoring, corrective action, and location restrictions). The Agency made a concerted effort to identify C&D damage cases by contacting 32 state agencies and was able to identify only 11 cases where there was a high probability that damages were associated with C&D wastes. The Agency's limited data (11 damage cases out of a total of approximately 1,800 C&D facilities) makes it difficult for the Agency to determine whether C&D facilities are posing sufficient risk to human health and the environment to warrant additional controls beyond those required by the statute.

Missouri Department of Natural Resources

Managing Construction and Demolition Waste

Solid Waste Management Program fact sheet 10/2008

This guidance is provided primarily for construction and demolition contractors, waste haulers, roofing contractors, remodeling businesses, homebuilders and homeowners. Cities and counties that issue building permits may also find the information helpful. The guidance covers only wastes commonly produced during building construction, renovation and demolition. Information about managing other wastes is available by contacting the sources listed on the last page of this fact sheet.

This fact sheet is not intended for guidance on the management of surface coatings removed from bridges, water towers or other similar outdoor structures.

Waste types

During construction, renovation and demolition activities, you may produce one or more of the following types of residuals:

- Clean fill.
- Recovered materials.
- Regulated construction and demolition waste.
- Hazardous materials and hazardous wastes.
- Asbestos-containing materials.

Management requirements differ for each of these.

Clean Fill

Clean fill is “uncontaminated soil, rock, sand, gravel, concrete, asphaltic concrete, cinder blocks, brick, minimal amounts of wood and metal and inert (non-reactive) solids...for fill, reclamation or other beneficial use” [§260.200(5), RSMo]. Minimal means the smallest amount possible. For example, concrete containing wire mesh or rebar may be used as clean fill. However, exposed rebar must be removed before use. Under no circumstances are roofing shingles, sheet rock, wood waste or other construction and demolition wastes defined as clean fill.

Concrete, cinder blocks, bricks or other clean fill materials that are painted with non-heavy metal-based paints are also considered clean fill. It is the generator’s responsibility to determine if the painted materials are hazardous wastes. The most typical contaminants are lead and other heavy metals. This determination can be made by representative sampling or by applying historical knowledge of the materials in question.

If asphaltic concrete is to be used as clean fill it is recommended that it not be crushed or ground any smaller than necessary. This will help to minimize the leaching of chemicals found within the asphaltic material.

Although not regulated as waste, placement of clean fill materials may be subject to requirements of the Missouri Department of Natural Resources' Water Protection Program if it is placed in contact with surface or subsurface waters of the state, or would otherwise violate water quality standards. Contact the Water Protection Program at 573-751-1300 if you have any questions. Local requirements concerning the use of clean fill may apply as well. Contact the Hazardous Waste Program at 573-751-3176 for questions about determining whether materials may be hazardous and for disposal options.

Recovered Materials

Recovered Materials are those removed for reuse (lumber, doors, windows, ceramic tile and glass) and those removed to be recycled into new products. Potentially recyclable construction and demolition wastes may include scrap metals, asphalt shingles, sheet rock, lumber, glass and electrical wire. However, it is important to remember that recovered waste must be used in some way.

Separating out certain wastes to be recycled into new products without having a market for them is expensive and pointless. Storing recovered materials indoors is expensive. Storing them outdoors may lower their value, since most will degrade or deteriorate when exposed to the weather. Depending on how they are stored, they may harbor rodents, provide breeding grounds for insects or be a potential fire hazard. Recyclables may not be collected and dumped on the ground while waiting for markets to develop. Therefore, before you deliver recyclable materials to a processing or recovery facility be sure the facility is legitimate.

The department's Solid Waste Management Program has information about many recycling facilities in Missouri. You may contact the program at 573-751-5401 or available on the Web at www.dnr.mo.gov/env/swmp/rrr/rrr.htm. If you plan to remove reusable or recyclable materials from construction and demolition waste, the sorting must take place at the construction or demolition site. The wastes cannot be hauled from the site and dumped for later sorting, except at a permitted processing facility or at a facility that has received a permit exemption from Soild Waste Management Program. Although the department strongly encourages the recovery or recycling of potential waste materials whenever possible, these activities must be done legally.

Regulated Construction and Demolition Wastes

Regulated construction and demolition wastes are those not classified as clean fill and not being reused or recycled. Regulated non-hazardous construction and demolition wastes must be disposed of at a permitted landfill or transfer station.

To avoid violating air and solid waste laws regulated non-hazardous construction and demolition wastes:

- Cannot be burned. An open burning permit may be applied for to burn untreated wood waste. Contact your nearest regional office for permit information and conditions.
- Cannot be buried (except at a permitted landfill).
- Cannot be hauled to private or public property and dumped, burned or buried, even with the landowner's permission.

If this happens, everyone involved, including the contractor(s), subcontractor(s), the hauler(s) and the landowner(s) can and will be held liable for the illegal disposal (§§260.210, 260.211 and 260.212, RSMo).

If you are a building contractor, you need to know that burying construction waste from a building anywhere on the property is illegal (§260.210.1, RSMo). See page four of this fact sheet for a description of penalties for illegal disposal of construction and demolition waste.

Hazardous Materials and Hazardous Wastes

Although you may find a variety of hazardous materials in old buildings, lead-based paint and asbestos are the most common items dealt with by demolition contractors.

Studies conducted by the U.S. Agency for Toxic Substances and Disease Registry, and by independent researchers, show that the health effects of lead exposure are greater than previously thought. Children are especially vulnerable to the effects of lead poisoning. Because lead and other toxic heavy metals may be contained in the wastes noted above, they require careful management and disposal. For many years, lead-based paint was used in residences and businesses for its stable coating properties. Although lead-based paint was virtually banned by the Consumer Product Safety Commission in 1978 for residential application, it is often encountered when buildings are renovated or demolished. Also, lead-based paint is still manufactured and sold for corrosion or rust inhibition on steel structures and for other industrial purposes. In older buildings, lead was also used for roofs, cornices, tank linings and electrical conduits. In plumbing soft solder, an alloy of lead and tin was used for soldering tinplate and copper pipe joints.

Additional guidance for handling demolition waste containing lead-based paint or other heavy metals, such as cadmium or chromium, is available by calling the department's Hazardous Waste Program at 573-751-3176.

Hazardous waste requirements for demolition wastes - Demolition-related waste categories typically include:

- Paint Residue - Paint chips, paint scrapings and contaminated blast residue from building renovations or demolition projects.
- Demolition Debris - Masonry, metal and boards that have been painted with lead-based or other heavy metal-based paint.
- Scrap Metal - Metal objects that contain lead or other heavy metals.

For households, the following management options apply, whether or not a contractor is doing the work for you:

- Paint Residue - Paint residue may be placed in the household trash. Before disposal, wrap it tightly in a plastic bag or other container. It will be picked up by your trash hauler and taken to a sanitary landfill for disposal.
- Demolition Debris - May be placed in your household trash. It may be picked up by your trash hauler and taken to a sanitary or demolition landfill for disposal.
- Scrap Metal - Scrap metal should be taken to a salvage yard for recycling. If this is not possible, the metal may be placed in your household trash and picked up by your waste hauler for disposal at a sanitary or demolition landfill.

For generators other than households - This category includes commercial and business enterprises, institutions and industrial buildings, and other structures not specifically identified.

Paint Residue must be laboratory tested before disposal. The appropriate test method is the Toxicity Characteristic Leaching Procedure, EPA Method 1311, which is described in Appendix 11 of the Code of Federal Regulations, Title 40, Part 261(40 CFR Part 261). The test must include the eight metals noted in 40 CFR Part 261.24 (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver). Environmental laboratories capable of conducting a Toxicity Characteristic Leaching Procedure may be found in the telephone directory's *Yellow Pages*. If one or more of analytical limits meets or exceeds the regulatory limit, the waste is hazardous.

Hazardous wastes must be managed, transported and disposed of according to the Missouri Hazardous Waste Management Law and Regulations. This may require the generator to send paint residue to a permitted hazardous waste disposal facility. In some cases, a lead smelter may accept lead-based paints for use in its lead production processes. If laboratory analysis shows that the paint residue is non-hazardous, it must be disposed of at a sanitary landfill as "special waste." Paint residue may not be disposed of in a demolition landfill.

Procedures for managing special wastes are included in the fact sheet titled *Special Waste* (PUB2050) available on the department's Web site at www.dnr.mo.gov/pubs/pub2050.pdf. The landfill may require you to complete a special waste disposal request form, and provide the results of testing on the paint waste to show that it is not hazardous before accepting the waste.

Demolition debris need not be tested before disposal, so long as it is not chipped, shredded, milled, ground, mulched or similarly processed. Processed demolition waste should be evaluated as described for paint residue.

Scrap metal painted with heavy metals may be sent to a salvage yard for recycling. If this is not possible, the metal may be disposed of at a sanitary or demolition landfill.

Asbestos

All public, institutional or commercial buildings, and in some instances, residential structures, must be inspected for asbestos before renovation or demolition activities. Before planning a demolition project, bidding a project, letting a bid or beginning the demolition, it is important to know if the building has any asbestos-containing materials and who is responsible for removing them. Buildings may contain asbestos in materials such as ceiling or floor tile, as insulation or soundproofing on ceilings, pipes, ductwork or boilers, or on the outside as transite siding or in shingles. The presence of asbestos-containing materials cannot be confirmed just by looking. A thorough inspection of any regulated building must be conducted by a Missouri certified asbestos inspector to determine the presence and condition of asbestos-containing materials. Depending upon the results of the inspection, a registered asbestos abatement contractor may be required. Contact the department's Air Pollution Control Program's Asbestos Unit at 573-751-4817 for more specific information about managing asbestos-containing materials. Visit www.dnr.mo.gov/env/apcp/Asbestos.htm for more information about asbestos requirements. If the asbestos-containing materials is to go to a landfill or transfer station, contact the facility in advance to see if they will accept materials and if they have any special handling or packaging requirements.

Penalties for illegal disposal of construction and demolition wastes

The Missouri Solid Waste Management Law provides for civil penalties for persons who dispose of or allow the disposal of regulated construction and demolition wastes in un-permitted areas. The law also contains criminal provisions for some types of illegal construction and demolition waste disposal. There may be additional penalties for violations of air, water pollution and hazardous waste laws depending on the situation and means of disposal.

Solid Waste Management Law Violations:

- **Civil Penalties** - any person who disposes of construction and demolition waste or allows the disposal of construction and demolition waste in an area not permitted for such disposal may be assessed a civil penalty of up to $5,000 per day per violation (§260.240, RSMo).
- **Criminal Penalties** - any person who purposely or knowingly disposes of or causes the disposal of regulated quantities of construction and demolition waste or other solid waste may be prosecuted for violating the criminal provisions of §§260.211 and 260.212, RSMo. Convictions may include fines of $20,000 or more, community service, and/or clean up of the

The NADC Reports:

Demolition Contractors Manage and Dispose of Waste Responsibly

A report based on research conducted by Gershman, Brickner & Bratton, Inc.

February 1995

Presented by

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How does the Demolition Industry Manage Project Sites and Segregate Waste Streams for Proper Handling?

What is demolition waste?

Before significant demolition activity begins, demolition contractors carefully inventory and isolate items, which are known to be hazardous. Materials, which are difficult to identify, or which are suspected of potentially having hazardous characteristics are also isolated. Suspect materials are either identified or tested in order to select an appropriate disposal method. Marketable timbers, metals, fixtures, and other materials from demolition projects which have value for reuse or recycling are segregated and recovered. The demolition industry annually recycles millions of tons of concrete, steel, and brick.

As a result of these efforts to isolate hazardous items for separate disposal and to reclaim materials of value, the demolition wastes, which are ultimately delivered to landfills, comprise only a portion of all the material initially found at demolition project sites. This landfilled fraction is composed of materials which cannot be economically recovered and which do not require special disposal arrangements. Numerous composition studies show this landfilled fraction to be primarily a mixture of unrecyclable concrete, wood, glass, metals, roofing materials, plastics, and dirt, an inert material.

Pre-demolition Inspections

A first step for demolition projects includes a walk-through visual inspection that helps to identify any transformers, drums, liquids, tanks, or other items, which will require special handling and/or testing. Site managers and crews are highly trained and drilled in the importance of identifying and isolating suspect materials. Many projects are begun only after the site owner or a third party environmental consultant performs a more formal site audit.

In addition, during the site inspection demolition contractors identify materials to be removed and sold for reuse or to be processed and recycled. This inspection process is also essential for the demolition contractor to identify any structural hazards, note any safety concerns and to determine the specific sequence that will be followed for the demolition activities.

Sequencing of Demolition Activities

Interior or partial demolition projects and an increasing number of total demolition projects are scheduled so that the removal of floor coverings, ceiling materials, interior wall, and other items occur in sequence before any structural demolition takes place. These steps maximize the efficiency and safety of the process and provide a further opportunity to inspect the waste materials as they are separately removed and readied for disposal.

Demolition contractors provide sophisticated safeguards for their businesses, employees, and projects by being experts in the applicable regulations for their projects: air quality, water quality, solid and hazardous waste, occupational safety, and noise, among others. The industry's standard practice entails careful assessment of project sites well in advance of demolition activities; specialized removal and disposal of potentially hazardous items; recycling of marketable equipment and extensive recycling of brick, concrete, and steel, along with growing efforts to recycle wood waste. The balance of materials from demolition project sites are landfilled.

Composition of Wastes Delivered to Demolition Landfills

The database compiled by GBB shows that the majority of wastes delivered to demolition landfills are made up of mixed concrete, wood, brick, rubble, metals (primarily ferrous), soil and fines, and smaller quantities of intermixed glass, plastics, textiles, and other materials.

The quantity and type of waste materials received by demolition landfills vary somewhat by the type of activity performed: site clearance, roadwork, excavation, building demolition, and construction/renovation. Some demolition landfills receive waste from all these types of activities; some accept only a more limited spectrum; for example, some accept wastes originating strictly from demolition operations. However, data from many sources shows a general materials profile for the wastes received at all studied demolition landfills, with wood waste dominating, followed by concrete and other rubble. Ferrous metals, glass, plastics, roofing materials, and other items comprise significantly smaller fractions of the mix.

The full waste composition database compiled by GBB is available from the NADC. This compilation of studies and investigations of demolition landfills across the U.S. shows a certain degree of uniformity in the categories of waste landfilled at these facilities, and the composition consists of a limited range of materials. In contrast, landfills for municipal solid waste (MSW - the aggregate wastestream from a community's commercial, residential, and industrial sources) and landfills for industrial waste disposal typically receive a very broad spectrum of waste types and quantities.

The waste characteristic of these facilities has a far higher organic fraction, and the generation of the incoming waste loads is from millions of untrained, often indifferent, casual generators. In contrast, demolition wastes originate from a highly specialized and trained industry, whose success in safeguarding the environment is evident, both in the uniformity of composition found in the database search as well as in the historical absence of significant environmental problems associated with landfills that have accepted only demolition wastes.

How are demolition landfills currently regulated?

State Regulations

GBB's nationwide survey found that over 40 of the 50 states have differentiated regulations for demolition landfills. However, where the states have regulated demolition landfills, their regulatory approaches have generally reflected the comparatively inert character of the demolition wastestream, and demolition landfill requirements have been far less complex than the requirements the states have put in force for the management and disposal of municipal solid wastes and industrial wastes.

For the majority of states which do regulate demolition landfills, a significant portion of the regulations rely heavily on disclosure of the location of small volume disposal facilities and on the innocuous character of the wastestream to provide a sufficient safeguard for disposal sites. Commonly, small demolition disposal sites are required only to provide a registration or notification of operations and to maintain simple records of the quantity and/or origin of wastes disposed.

Most states which have adopted more formal permit or license requirements for demolition landfills have some form of groundwater monitoring requirement as well. GBB's analysis, however, has found that these standards are often inadequate to document both background groundwater quality as well as a discernible identification of the effects of the monitored facilities.

What are the operating practices and design characteristics of a state-of-the-art landfill serving the demolition industry?

Based on the experience of the demolition industry, the NADC has identified an inventory of the operating practices and design characteristics that it considers to be representative of a demolition landfill that reflects current industry standards. For many situations, these attributes would exceed the minimum existing regulatory requirements. However, they are viewed by the NADC as representing an industry guideline for prudent, environmentally responsible operations.

Table 2: Operating Practices and Design Characteristics for State-of-the-Art Demolition Landfills	
Responsible, trained personnel	Appropriate supervision of facility operations; training requirements for all on-site employees
Routine Procedures and Protocols	Plan of Operations or Operations Manual; training in site safety/operational practices required of all staff
Defined Listing of Acceptable and Unacceptable Wastes	Wastes allowable for receipt well defined; personnel trained in identification
Inspection of All Incoming Waste Loads	Required disclosure of waste type and source; visual inspection of material when delivered also when placed on working face
Isolation and Analysis of Suspect Materials	Requirements for and routine practice of isolation of suspect materials; documented procedures for identification, isolation, testing, and disposal of unacceptable and suspect wastes
Siting	Suitable site surface and subsurface conditions; Compatible with adjacent land uses
Leachate Containment	Capacity to contain leachate either through native soil conditions, compaction of native soils, or other containment system
Groundwater Monitoring	Upgradient (background) and downgradient groundwater monitoring for appropriate parameters, tested at least annually
Record Keeping	Maintenance of records of waste receipts and waste placements
Financial Assurance	Long-term funding for post-closure cover maintenance
Closure Plan	Design for installation and maintenance of final cover

These standards and practices provide an assurance that demolition landfills are repositories of only those wastes appropriate for disposal at these sites and the corresponding assurance that unacceptable materials are diverted to proper management alternatives; long-term monitoring of the environment; and assurance of permanent facility care.

Just as demolition contractors apply stringent controls to ensure that hazardous materials are separately removed from project sites and properly disposed, similarly, state-of-the-art demolition landfills must apply clear, consistent standards to define wastes acceptable for disposal. This is among the best, most effective means of environmental control for demolition facilities. Training for site operators and personnel, training and informational materials for haulers and facility users; rigorous screening of incoming loads; records of gate receipts and disposal placement all are hallmarks of facilities which follow NADC guidance. Such steps can ensure that the long-standing characterization of demolition waste as environmentally innocuous is well-founded.

What are the characteristics of leachate from demolition landfills?

The third database developed for the NADC by GBB entailed compilation and review of demolition landfill leachate monitoring records and other background documentation about the quality of leachate generated from demolition landfills across the United States.

Data from MSW Sites is not Representative of Demolition Landfills

GBB's 1994 research and assessment found that many of the existing reports and leachate data supposedly about "demolition landfills" are seriously flawed. Municipal solid waste has very different characteristics from demolition debris, and obviously, sizable deposits of municipal solid waste at facilities would skew the groundwater monitoring data considerably. Several sites classified as construction/demolition landfills (sites supposedly accepting only demolition and construction waste) were found to have accepted municipal solid waste for some period of time. It is suspected that many facilities were converted to construction/demolition landfills rather than attempt to comply with contemporary regulations for municipal solid waste sites. Regardless of such facilities' present suitability for demolition waste disposal, leachate data from such dual purpose facilities cannot be used to validly characterize the effects of construction/demolition wastes.

Leachate Data from a State-of-the-Art Demolition Landfill

The research effort found excellent long-term leachate test documentation (more than 5 years) from a state-of-the-art demolition landfill operated in a major midwestern metropolitan area. Reports provided by this facility to its state regulators document leachate characteristics on a quarterly basis. Because the facility is lined and leachate is collected, the information is comprehensive.

The facility operator has concluded that the facility's waste receipts are characteristic of the mix of materials regularly received by demolition landfills, and the NADC considers the data from this facility to be the best current information representative of leachate characteristics for demolition landfills meeting industry standards.

Representative Leachate Data for Demolition Landfills

Tables 3 and 4 are excerpted from the GBB's technical analysis of the leachate database. On Table 3, the first column identifies the National Drinking Water Standard's Maximum (allowable) Contaminant Levels (MCL). The second column lists the published range of leachate concentrations found for demolition landfills, including those for which the data is flawed by a past history of MSW disposal. The third column, headed "Potential Surrogate Range C & D Landfills," provides a calculated range - a surrogate - for the range of contaminants in the demolition landfill leachate. This calculated range is based heavily on the record of analysis for the representative midwestern demolition landfill described above.

The table indicates that contaminant concentrations in leachate from a state-of-the-art demolition landfill, as represented by the "Potential Surrogate Range" values, would not exceed primary national drinking water standards.

Table 4 compares the representative values for demolition landfill leachate, the "Potential Surrogate Range" in column 3, with one source's published data and its estimates of leachate concentrations for MSW landfills. As is quickly evident in a scan of the table, for most listed parameters, the "Potential Surrogate Range" representative of demolition facilities shows values far below those found at MSW sites, often by at least an order of magnitude.

Of special note is the fact that the GBB database showed that lead is not a major component of demolition landfill leachate even with high lead paint content often found in older demolition projects. The U.S. EPA has recently taken these findings into account in development of a proposed disposal standard for lead-based paint contaminated debris.

On Table 4, sulfate, a substance that is essentially environmentally innocuous, is the one parameter for which there is an exception to the pattern of higher concentrations in MSW leachate. The higher sulfate concentrations estimated for demolition facilities are associated with the higher volumes of concrete and rubble disposed at demolition sites.

Table 3. Leachate Data Summary [1]

	MCL[2]	Published Range C&D Landfills[4]	Potential Surrogate Range C&D Landfills
Metals (mg/L)			
Arsenic	0.05	ND-0.12	<0.002-0.02
Barium	1.0	0.05-0.8	0.1-0.16
Cadmium	0.005	ND-2.05	0.0001-<0.0004
Chromium	0.10	ND-0.45	<0.001-<0.01
Lead	0.05	0.0002-0.669	<0.0002-<0.003
Manganese	0.05[3]	0.019-258	<0.08-12
Selenium	0.01	ND-<0.02	<0.02
Zinc	5.0[3]	ND-0.81	<0.01-0.03
Volatile Organics (mg/L)			
Trichloroflouromethane	N/A	<0.02-13	<0.02-0.25
1,2 Dichloroethane	0.005	<0.0004-26	<0.0004-0.0008
Trichloroethane	--	<0.025	<0.025
1,1,1-Trichloroethane	0.2	0.0006-<0.025	<0.001-<0.025
Ethyl Benzene	0.7	0.0008-18	<0.0008-<0.025
Conventional Parameters			
Alkalinity	N/A	ND-18	410-1450
Calcium	N/A	<0.03-600	280-600
Chloride	250[3]	8-2400	100-460
Chemical Oxygen Demand(COD)	--	ND-1100	110-230
Conductivity	--	220-2010	1000-2010
Cyanide	0.2	ND-0.02[5]	0.01-0.02[5]
Hardness	N/A	150-2420	340-2420
Iron	0.3[3]	0.02-93.4	0.02-14
Nitrogen, Organic	--	0.07-2.4	0.07-1.5
Nitrogen, Nitrate	10	ND-10	<0.25-3.5
Nitrogen, Ammonia	--	ND-170	<.05-1.2
pH (unit)	6.5-8.5[3]	6.2-7.24	6.8-7.1
Sulfate	250[3]	11.7-2700	730-1700
Total Dissolved Solids (TDS)	500[3]	270-8400	1700-5740
Total Suspended Solids (TSS)	--	<4-5000	<4-320

[1]C&D Waste Project Report, *A Preliminary Report on Demofill Leachate Quality* prepared for the National Association of Demolition Contractors (NADC), prepared by Gershman, Brickner & Bratton, Inc., February 14, 1995

[2]MCL = Maximum Contaminent Level - National Primary Drinking Water Standards.

[3]National Secondary Drinking Water Standards

[4]Includes data from facilities that accepted MSW for some period of time.

[5]Exclusive of complex; highest complex is 0.34.

ND = Not-detected All quantities mg/L unless otherwise noted.

Table 4. Comparison of Published MSW Landfill and C&D Landfill Leachate Data [1]

	Published Range MSW Leachate Data[2]	Surrogate MSW Leachate Data[3]	Potential Surrogate Range C&D Landfills[4]
Metals (mg/L)			
Arsenic	5.0-1600	0.0039-0.12	<0.002-0.02
Cadmium	0.5-140	ND-0.013	0.0001-<0.0004
Chromium	30-1600	ND-0.12	<0.001-<0.01
Lead	8-1020	ND-0.25	<0.0002-<0.003
Zinc	0.03-4	ND-53	<0.01-0.03
Conventional Parameters			
Alkalinity	300-11500	DNP	410-1450
Chloride	100-5000	99-3300	100-460
Chemical Oxygen Demand(COD)	500-4500	97-8100	110-230
Iron	3.0-280	3.3-320	0.02-14
Nitrogen, Nitrate	0.1-50	DNP	<0.25-3.5
Nitrogen, Ammonia	30-3000	DNP	<.05-1.2
pH (unit)	7.5-9	6.2-8.3	6.8-7.1
Sulfate	10-420	ND-330	730-1700
Total Dissolved Solids (TDS)	--	480-24000	1700-5740
Total Suspended Solids (TSS)	--	26-7400	<4-320

[1]Excerpted data from referenced reports for comparison purposes only; mg/L unless otherwise noted.

[2]Norstrom, James M. et al *Properties of Leachate from Construction/Demolition Waste Landfills (presented at the Fourteenth Annual Madison Waste Conference)* September 25-26, 1991 and from Waste Age Landfill Course, July 1991.

[3]Wastewater Treatment Group (Waste Management of North America, Inc.) *Construction & Demolition Landfill Leachate Study,* December 1991.

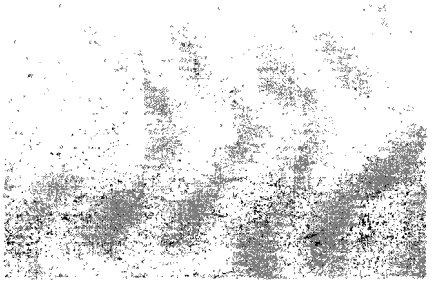
[4] Consolidated database from Table 3.

DNP = Data Not Provided in referenced report.

State of Ohio
Environmental Protection Agency

Division of Solid and Infectious Waste Management

An Evaluation of Leachate from Ohio's Construction and Demolition Debris Landfills



Draft: June 12, 2009

Ted Strickland, Governor
Chris Korleski, Director

Contents

Executive Summary

In 2005, the Ohio General Assembly required Ohio EPA to revise its construction and demolition debris disposal regulations. The agency published draft regulations in 2006 and received extensive comments from stakeholders and other interested parties. In response to comments received, Ohio EPA conducted additional technical studies, including an evaluation of leachate data from Ohio's C&DD landfills. In 2007, Ohio EPA also sampled all of the operating C&DD landfills and one closed C&DD landfill in Ohio where access to Leachate existed (30 C&DD landfills). There are 56 licensed C&DD landfills in Ohio.

The conclusions of this report are as follows:

Ohio C&DD leachate contains a wide variety of inorganic parameters including heavy metals, light metals, trace elements, and other ions. It also contains a wide variety of organic parameters including pesticides, chlorinated solvents, non-chlorinated solvents, gasoline, substituted benzenes, phenolics, chlorofluorocarbons, polycyclic aromatic hydrocarbons (PAHs), phthalates, substituted alkanes, and alcohol.

The leachate from all 30 C&DD landfills had from 3 to 29 parameters with concentrations that exceeded health based standards, surface water quality standards, or both. The median was 12.5 parameters exceeding the standards. The leachate from 29 of the 30 C&DD landfills had eight or more parameters that exceeded the standards.

The wide variety of parameters detected in C&DD leachate, the wide variation in the number of parameters that exceeded health based standards and surface water quality standards in C&DD leachate and the magnitude of the exceedances are evidence that C&DD is not harmless or inert.

There are numerous parameters that were often detected in Ohio C&DD leachate of sufficient concentration that would violate discharge limits of Ohio rules if released to ground water or surface water. They could also cause or contribute to water pollution, and could adversely impact downgradient or downstream residential and public drinking water supplies. Of particular concern are those parameters that were found in C&DD leachate that were multiples of the health based standards (such as arsenic, boron, manganese, and lead), carcinogens (such as arsenic, vinyl chloride, and benzene), mobile in the environment (such as arsenic, vinyl chloride, and benzene), persistent in the environment (such as antimony and lead), or which bioaccumulate (such as arsenic, copper, lead, mercury, nickel, and zinc).

The concentrations of the parameters in Ohio C&DD leachate exceeded secondary maximum concentration limits (SMCLs) to the extent that discharge of the leachate with the average concentrations could render good quality ground water objectionable or unusable for consumption, washing, and industrial production.

Leachate from Ohio C&DD landfills poses a threat to public health and the environment if released to ground water or surface water. The threat is posed by a variety of organic parameters, metals, and inorganic parameters. The degree of risk associated with the threat by a release is dependent upon how the C&DD was disposed, site conditions, and circumstances surrounding the site, which often change over time. This conclusion is supported by numerous studies showing that impacts by C&DD landfills to surface water and ground water have occurred or were indicated (US EPA, Draft 1995b), (Hamilton County General Health District, 2001), (Ohio EPA, 2006), (Townsend, Jambeck, & Clark, 2002), and (Ohio EPA, 2008).

This information should be taken into account by the regulated community, citizens, legislators, and regulators when developing public policy and rules for the management of C&DD and the permitting, construction, operation, closure, and post closure care of C&DD landfills.

Synopsis of the Ohio C&DD Leachate Analytical Data

The conclusions stated on the previous page are supported by the following observations:

- Of the 30 C&DD landfills that had leachate sampled:
  - Each landfill had 3 to 29 parameters that exceeded health based standards for toxicity or carcinogenicity, surface water quality standards, or both.
  - The median number of parameters exceeding standards was 12.5.
  - 29 of the landfills had eight or more parameters that exceeded standards.

- Of the 273 parameters analyzed in the leachate at each landfill:
  - 95 parameters were detected at one or more C&DD landfill.
  - 79 parameters were detected at two or more C&DD landfills.

- Of the parameters detected in C&DD leachate:
  - 30 were chlorinated solvents and pesticides.
  - 25 were heavy metals, light metals, and trace elements.
  - 7 were non-chlorinated solvents.
  - 7 were other ions.
  - 5 were gasoline components.
  - 5 were substituted benzenes.
  - 4 were phenolics.
  - 2 were chlorofluorocarbons.
  - 2 were polycyclic aromatic hydrocarbons (PAHs).
  - The remaining 8 were an alcohol, a pthalate, a substituted alkane, chemical oxygen demand (COD), pH, total dissolved solids (TDS), total alkalinity and one miscellaneous organic compound.

- Of the 95 parameters detected in C&DD leachate, 28 exceeded health based standards, including:
  - 16 heavy metals, light metals, and trace elements.
  - 4 chlorinated solvents and pesticides.
  - 4 other ions and TDS.
  - 4 that were a gasoline component, a PAH, a phenolic, and a phthalate.

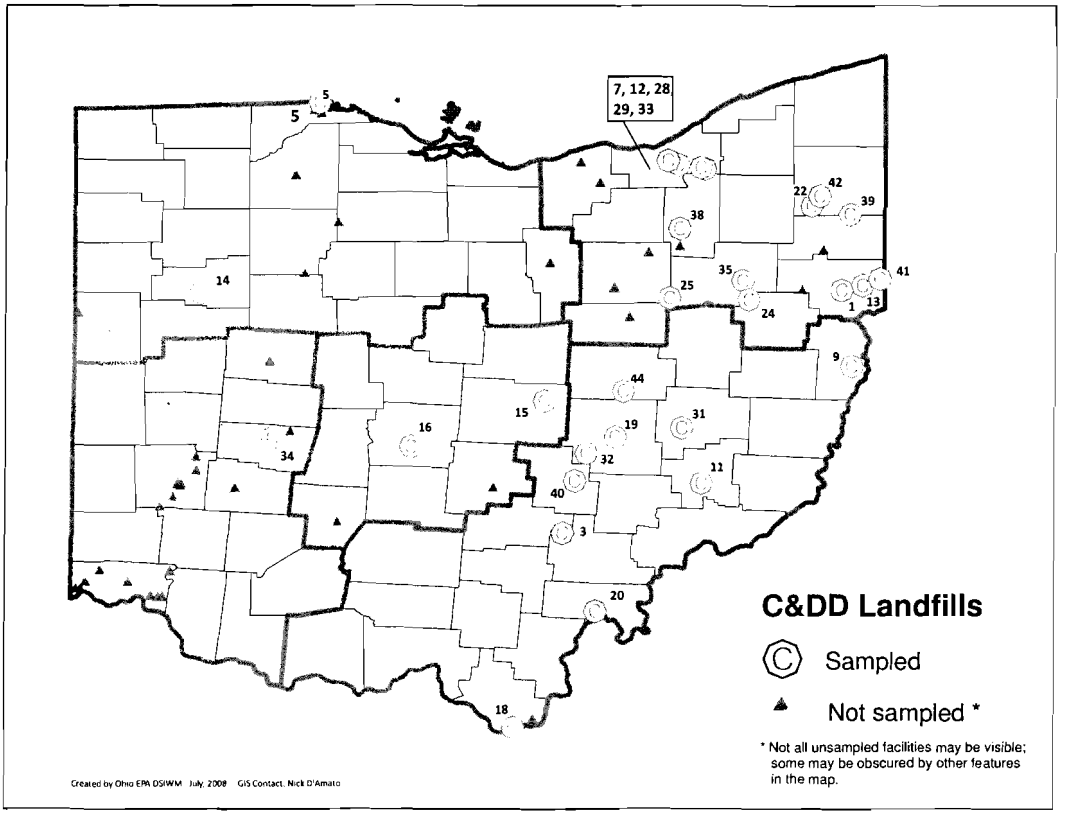
- Of the 95 parameters detected in C&DD leachate, 46 exceeded surface water quality standards, including:
  - 18 heavy metals and trace elements.
  - 10 chlorinated solvents and pesticides.
  - 5 other ions and TDS.
  - 4 phenolics.
  - 2 gasoline components.
  - 2 light metals.
  - 2 PAHs.
  - 3 that were a non-chlorinated solvent, a phthalate, and a substituted benzene.

- Of the 95 parameters detected in C&DD leachate, 52 raised a concern when compared with health based standards or surface water quality standards. Of those 52 parameters, 27 raised a concern with both sets of standards.

- Of the 95 parameters detected in C&DD leachate, 18 were identified in a 2008 Ohio EPA study as showing indications of impact on ground water at Ohio C&DD landfills, including:
  - 6 light metals and trace elements.
  - 4 other ions.
  - 2 gasoline components.
  - 6 that were a substituted benzene, a heavy metal, COD, pH, TDS, and total alkalinity.

Materials and Methods

During the statewide C&DD leachate sampling event in 2007, Ohio EPA collected samples from all of the Ohio C&DD landfills that had a sump, pipe, or tank to draw samples from (See Figure 1). This resulted in 30 landfills being sampled. No attempt was made to obtain samples from the remaining Ohio C&DD landfills since it would have required boring into the disposed debris.



Legend	NAME	COUNTY	DISTRICT	Legend	NAME	COUNTY	DISTRICT
1	A&L Salvage	Columbiana	NEDO	24	Minerva Enterprises	Stark	NEDO
3	Athens-Hocking LF	Athens	SEDO	25	Mount Eaton East Landfill	Wayne	NEDO
5	Lucas County Landfill LLC	Lucas	NWDO	28	RKDF (Kurtz)	Cuyahoga	NEDO
7	Boyas Excavating Inc	Cuyahoga	NEDO	29	Rosby Resource	Cuyahoga	NEDO
9	C&D Disposal Technologies L	Jefferson	SEDO	31	S W Land Co	Guernsey	SEDO
11	Crock Construction C & DD	Noble	SEDO	33	SILVER OAK	Cuyahoga	NEDO
12	Cuyahoga CDD	Cuyahoga	NEDO	34	Springfield LF LLC	Clark	SWDO
13	Elkrun Industries, Inc.	Columbiana	NEDO	35	Stark CDD	Stark	NEDO
14	EQLM	Allen	NWDO	32	Sidwell Materials	Muskingum	SEDO
15	Fallsburg Rd. / Roberts CDD	Licking	CDO	39	TWL – LAS	Trumbull	NEDO
16	Frank Rd. CDD	Franklin	CDO	38	Summit C & D Disposal Inc	Summit	NEDO
18	Iron Valley	Lawrence	SEDO	40	Tunnel Hill Reclamation	Perry	SEDO
19	James Bros C & D Disposal F	Muskingum	SEDO	41	TWL - Penn Ohio	Columbiana	NEDO
20	Jeffers	Meigs	SEDO	42	Warren Recycling Inc	Trumbull	NEDO
22	Lordstown Cons.	Trumbull	NEDO	44	William Albert C&DD Disposal	Coshocton	SEDO

Category	Parameter Name
Alcohols	Isobutanol
Substituted Benzenes	1,2-Dichlorobenzene
	Chlorobenzene
	Dibenzofuran
	p-Isopropyltoluene
	Styrene
Chlorinated solvents	1,1,1-Trichloroethane
	1,1-Dichloroethane
	1,2-Dichloroethane
	Chloroethane
	Chloroform
	cis-1,2-Dichloroethene
	Methylene chloride
	Tetrachloroethene
	trans-1,2-Dichloroethene
	Trichloroethene
	Vinyl chloride
Chlorofluorocarbons	Dichlorodifluoromethane
	Trichlorofluoromethane
Gasoline	Benzene
	Ethylbenzene
	m-,p-Xylene
	o-Xylene
	Toluene
Non-chlorinated solvents	2-Butanone
	2-Hexanone
	4-Methyl-2-pentanone
	Acetone
	Acetophenone
	Benzyl alcohol
	Carbon disulfide

Category	Parameter Name
PAHs	Acenaphthene
	Naphthalene
Pesticides	1,4-Dichlorobenzene
	2,4,5-TP (Silvex)
	2,4-D
	2,4-DB
	4,4'-DDE
	4,4'-DDT
	alpha Chlordane
	Dicamba
	Dichloroprop
	Dieldrin
	Disulfoton
	EPN
	gamma Chlordane
	Heptachlor
	Heptachlor epoxide
	MCPA
	MCPP
	Methoxychlor
	Pentachlorophenol
Phenolics	2,4-Dimethylphenol
	2-Methylphenol
	3-,4-Methylphenol
	Phenol
Phthalates	bis(2-Ethylhexyl) phthalate
Substituted alkanes	1,2-Dichloropropane
Other organic	Bis(2-Chloroethoxy) Methane

*Highlighted parameters were also listed as detected in the study, "Construction and Demolition Waste Landfills" (US EPA, Draft 1995a)

Category	Parameter Name
Heavy metal, Totals and dissolved	Antimony
	Arsenic
	Barium
	Beryllium
	Cadmium
	Lead
	Mercury
	Nickel
	Thallium
Light metal, Totals and dissolved	Aluminum
	Calcium
	Magnesium
	Potassium
	Sodium
	Strontium
	Vanadium

Category	Parameter Name
Other ions	Chloride
	Cyanide, Weak/Dissociable
	Fluoride
	Nitrogen, Ammonia
	Nitrogen, Nitrate-Nitrite
	Sulfate
	Sulfide
Trace element, Totals and dissolved (except phosphorus)	Boron
	Chromium
	Cobalt
	Copper
	Iron
	Manganese
	Selenium
	Phosphorus
	Zinc

Chemical Oxygen Demand	COD
pH	pH
Total Dissolved Solids	TDS
Total Alkalinity	Total Alkalinity

*Highlighted parameters were also listed as detected in the study, "Construction and Demolition Waste Landfills" (US EPA, Draft 1995a).

Based on historical information, such as the sources cited in the introduction (see especially (US EPA, Draft 1995a)), it was expected that approximately 90 parameters would be detected; 95 were detected. It was also expected that metals and inorganic parameters would be the primary constituents detected in Ohio's C&DD leachate; with approximately 55 of the 90 parameters being metals and inorganic compounds. However, the results from Ohio EPA's leachate analysis provided the surprising result that only 36 metals and inorganic parameters were detected, which was lower than expected. It was also expected that approximately 35 organic parameters would be detected in Ohio's C&DD leachate. However, what was found was that 59 organic parameters were detected. There were a wide variety of organic parameters detected. It was surprising that pesticides, chlorinated solvents and non-chlorinated solvents would be such a large proportion (40 percent) of parameters detected when compared with the proportion of metals and inorganic parameters detected (38 percent).

Evaluation of pH, Total Alkalinity, TDS, and COD

pH

The pH of Ohio C&DD leachate ranges from 6.6 standard units (S.U.) to 7.94 S.U. with a mean measurement of 7.1 S.U. The 95 percent confidence limits for the mean shows that the mean is expected to be from 7.0 S.U. to 7.3 S.U. Iron Valley C&DD landfill and TWL - Penn Ohio C&DD landfill each had a pH measurement (7.71 and 7.94 S.U., respectively) that was a high outlier when compared with the other C&DD landfills (See Figure 3).

For two of the landfills that had multiple samples measured for pH (Summit C&D Disposal, Inc. and TWL-Penn Ohio), each had one result for pH recorded at 9.04 S.U. This value is extreme

Summary

Ohio C&DD leachate from 30 landfills was analyzed for 273 parameters; 95 parameters were detected at one or more C&DD landfill.

Of those 95 parameters:

- 64 percent were organic parameters (59 parameters).
- 23 percent were light metals, trace elements, and other ions (23 parameters).
- 9 percent were heavy metals (9 parameters).
- The remaining percentage was made up of COD, pH, TDS, and total alkalinity.

Two metals (silver and tin) were not detected at any C&DD landfill. Organic parameters comprised the remaining 178 parameters that were not detected.

The most common parameters detected in Ohio C&DD leachate in order from most to fewest were trace elements, light metals, other ions, heavy metals, gasoline, chlorinated solvents, pesticides, non-chlorinated solvents, substituted benzenes, PAHs, phenolics, and chlorofluorocarbons accounting for 89 percent of the parameters detected. COD, pH, TDS, and total alkalinity were measured at all of the landfills, which accounts for 10 percent of the detections. The remaining one percent of detections included phthalates, substituted alkanes, alcohols, and one miscellaneous organic parameter. Also expected was the high detection frequency of trace elements, light metals, other ions, and heavy metals.

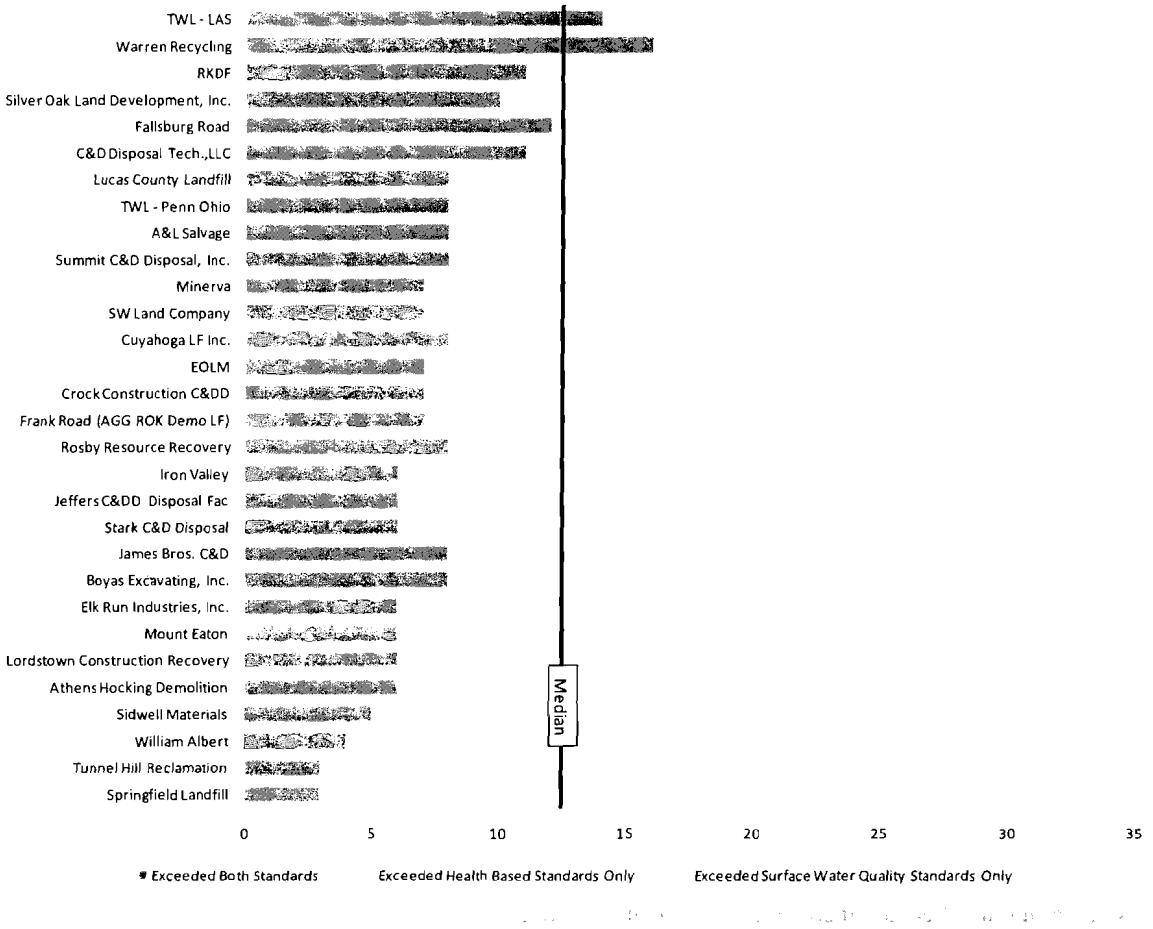
What was unexpected was the high detection frequency of gasoline, chlorinated solvents, pesticides, and non-chlorinated solvents.

The dominant anion in Ohio C&DD leachate was bicarbonate. Chloride typically made up less than 20 percent of the major anions in Ohio C&DD leachate. There was no dominant cation, though the leachate tended to have a higher proportion of calcium and magnesium than the other major cations.

Since the majority of the C&DD landfills plot in one quadrant of each section of the Piper diagram, Piper diagrams may prove useful when comparing C&DD leachate with leachate from other types of landfills, ground water, and surface water. However, seven of the landfills (1/4) did not fit the typical profile of C&DD leachate demonstrated by the other 23 landfills. This shows that there was wide variability from landfill to landfill in the proportions of the major ions.

The leachate from all 30 C&DD landfills had from 3 to 29 parameters with concentrations that exceeded health based standards, surface water quality standards, or both. The median was 12.5 parameters exceeding the standards. The leachate from 29 of the 30 C&DD landfills had eight or more parameters that exceeded the standards (See Figure 12). The one landfill that had less than eight parameters that exceeded standards is suspected of having leachate that was diluted from ground water infiltration, surface water run-on, or precipitation.

Number of Parameters at Each Ohio C&DD Landfill that Exceeded Health Based Standards, Surface Water Quality Standards, or Both



Of the 95 parameters detected in C&DD leachate, 52 raised a concern when compared with health based standards or surface water quality standards. Of those 52 parameters, 27 raised a concern with both sets of standards. Twenty three parameters (56 percent) were organic parameters and 29 parameters (44 percent) were metals and inorganic parameters (See Table 19).

Row No.	No. of Facilities with Detects	Chemical Abstract Service No. (CAS)	Parameter Category	Parameter	Level of Concern due to HB Standards H=High, M=Moderate, N=Noteworthy	Level of Concern due to SWQ Standards H=High, M=Moderate, N=Noteworthy
			Organic Parameters			
1	7	75-09-2	Chlorinated solvents	Methylene chloride	M	M
2	13	75-01-4	Chlorinated solvents	Vinyl chloride	H	H
3	24	71-43-2	Gasoline	Benzene	H	H
4	3	108-88-3	Gasoline	Toluene	-	M
5	18	75-15-0	Non-chlorinated solvents	Carbon disulfide	-	M
6	1	83-32-9	PAHs	Acenaphthene	-	N
7	21	91-20-3	PAHs	Naphthalene	M	M
8	1	72-55-9	Pesticides	4,4'-DDE	-	N
9	1	50-29-3	Pesticides	4,4'-DDT	-	N
10	2	5103-71-9	Pesticides	alpha Chlordane	-	M
11	1	60-57-1	Pesticides	Dieldrin	-	N
12	1	298-04-4	Pesticides	Disulfoton	N	-
13	3	5103-74-2	Pesticides	gamma Chlordane	-	H
14	1	76-44-8	Pesticides	Heptachlor	-	N
15	1	1024-57-3	Pesticides	Heptachlor epoxide	-	N
16	1	94-74-6	Pesticides	MCPA	N	-
17	3	87-86-5	Pesticides	Pentachlorophenol	M	M
18	1	105-67-9	Phenolics	2,4-Dimethylphenol	-	N
19	26	95-48-7	Phenolics	2-Methylphenol	-	N
20	3	106-44-5	Phenolics	3-,4-Methylphenol	H	H
21	3	108-95-2	Phenolics	Phenol	-	H
22	4	117-81-7	Phthalates	bis(2-Ethylhexyl)phthalate	H	H
23	1	132-64-9	Substituted benzenes	Dibenzofuran	-	N
			Metals and Inorganic Parameters			
24	18	7440-36-0	Heavy metal, Totals	Antimony, Total	M	M
25	23	7440-38-2	Heavy metal, Totals	Arsenic, Total	H	H
26	30	7440-39-3	Heavy metal, Totals	Barium, Total	M	H
27	6	7440-41-7	Heavy metal, Totals	Beryllium, Total	M	N
28	3	7440-43-9	Heavy metal, Totals	Cadmium*	N	N
29	11	7439-92-1	Heavy metal, Totals	Lead, Total	H	H
30	6	7439-97-6	Heavy metal, Totals	Mercury, Total	-	H
31	25	7440-02-0	Heavy metal, Totals	Nickel, Total	M	M
32	16	7440-28-0	Heavy metal, Totals	Thallium, Total	M	M
33	21	7429-90-5	Light metal, Totals	Aluminum, Total	N	H
34	30	7440-23-5	Light metal, Totals	Sodium, Total	N	-
35	30	7440-24-6	Light metal, Totals	Strontium, Total	H	-
36	10	7440-62-2	Light metal, Totals	Vanadium, Total	M	M
37	30	7440-42-8	Trace element, Totals	Boron, Total	H	H
38	26	7440-47-3	Trace element, Totals	Chromium, Total	M	M
39	16	7440-48-4	Trace element, Totals	Cobalt, Total	-	M
40	15	7440-50-8	Trace element, Totals	Copper, Total	-	H
41	29	7439-89-6	Trace element, Totals	Iron, Total	N	H
42	30	7439-96-5	Trace element, Totals	Manganese, Total	H	H
43	20	7723-14-0	Trace element, Totals	Phosphorus	-	H
44	6	7782-49-2	Trace element, Totals	Selenium, Total	-	H
45	21	7440-66-6	Trace element, Totals	Zinc, Total	-	H
46	30	16887-00-6	Other ions	Chloride	N	H
47	15	57-12-5	Other ions	Cyanide, Weak/Dissociable	-	H
48	30	16984-48-8	Other ions	Fluoride	N	N
49	30	7664-41-7	Other ions	Nitrogen Ammonia	N	H
50	30	14808-79-8	Other ions	Sulfate	N	H
51	30	none-8	pH	pH	N	N
52	30	none-4	TDS	Total Dissolved Solids	N	H

Cadmium, is counted as noteworty based on both total and dissolved concentrations for the reasons discussed in the narrative found immediately above Table 5.

When compared with health based standards:

- There is a high level of concern for nine parameters, including one chlorinated solvent (vinyl chloride), one gasoline component (benzene), two heavy metals (arsenic and lead), one light metal (strontium), one phenolics (3-,4-methylphenol), one phthalate (bis(2-ethylhexyl)phthalate), and two trace elements (boron and manganese).

  These parameters were detected at multiple C&DD landfills and frequently exceeded health based standards; the health based standard exceeded was for protecting against toxic or carcinogenic effects; and the magnitude of the exceedances were large, with maximum concentrations detected from 2.3 times (strontium) to 80 times (bis(2-ethylhexyl)phthalate) the health based standards.

  For four of the parameters (arsenic, boron, manganese, and strontium) it is likely that these parameters will often be detected at concentrations equal to or in excess of the health based standards during future leachate sampling.

  For two other parameters (3-,4-methylphenol and bis(2-Ethylhexyl)phthalate), which though they were detected less frequently, when detected were likely to exceed the health based standards.

- There is a moderate level of concern for 10 parameters, including one chlorinated solvent (methylene chloride), five heavy metals (antimony, barium, beryllium, nickel, and thallium), one light metal (vanadium), one PAH (naphthalene), one pesticide (pentachlorophenol) and one trace element (chromium). These parameters were determined to be of moderate concern because:

  - Less than 50 percent of the landfills sampled exceeded the standard for these parameters.

  - Based on the upper and lower confidence limits the mean concentration across all of Ohio's C&DD landfills would be expected to be less than 60 percent of the standard for each of these parameters, except methylene chloride, which has an upper confidence limit of 99 percent of the health based standard.

  - None of the parameters had minimum detected concentrations that exceeded a standard.

  - However, the maximum concentrations detected of these parameters exceeded the health based standard from 1.15 times (naphthalene) to 16.4 times (methylene chloride).

  - Methylene chloride could have been assigned a high level of concern because it has toxic effects and is a suspected carcinogen. However it was assigned a moderate level of concern even though the maximum detected concentration was more than 16 times the standard and the upper confidence limit was 99 percent of the standard because the parameter was detected at seven landfills and exceeded the standard at only two landfills. If additional sampling shows that methylene chloride is detected more frequently, or exceeds the health based standard at more landfills, it is recommended that the level of concern be raised to "high."

- Aluminum, chloride, iron, ammonia, sodium, sulfate, and TDS were determined to be noteworthy because they exceeded SMCLs and are likely to exceed the SMCLs during future leachate sampling at C&DD landfills.

- Other noteworthy parameters include: pH, cadmium, fluoride, and the pesticides, MCPA and disulfoton either because they were found in all C&DD landfill leachate samples and exceeded 70 percent of the health based standards or were infrequently found but exceeded the health based standards.

When compared with surface water quality standards:

- A high level of concern exists for one chlorinated solvent (vinyl chloride), one gasoline component (benzene), four heavy metals (arsenic, barium, lead, and mercury), one light metal (aluminum), four other ions (chloride, cyanide, ammonia, and sulfate), one pesticide (gamma chlordane), two phenolics (3-,4-methylphenol, phenol), one phthalate (bis(2-ethylhexyl)phthalate), seven trace elements (boron, copper, iron, manganese, phosphorus, selenium, and zinc), and TDS. The maximum detected concentration for these parameters exceeded the surface water quality standards from 4.7 times (cyanide and chloride) to 2,323 times (iron).

- A moderate level of concern exists for one chlorinated solvent (methylene chloride), one gasoline component (toluene), three heavy metals (antimony, nickel, and thallium), one light metal (vanadium), one non-chlorinated solvent (carbon disulfide), one PAH (naphthalene), two pesticides (alpha chlordane and pentachlorophenol), and two trace elements (chromium and cobalt). These parameters were less likely to exceed the surface water quality standards when detected in C&DD leachate. However, they can be considered typical parameters in C&DD leachate and had maximum concentrations detected were from 1.1 times (toluene) to 6.5 times (vanadium) the surface water quality standards.

  Methylene chloride could have been assigned a high level of concern because it has toxic effects and is a suspected carcinogen. However it was assigned a moderate level of concern even though the maximum detected concentration was more than 16 times the standard and the upper confidence limit was 99 percent of the standard because the parameter was detected at seven landfills and exceeded the standard at only two landfills. If additional sampling shows that methylene chloride is detected more frequently, or exceeds the surface water quality standard at more landfills, it is recommended that the level of concern be raised to "high."

  Alpha chlordane could also have been assigned a high level of concern because it persistent in the environment and causes adverse effects to aquatic life at very low concentrations. However it was assigned a moderate level of concern even though the minimum concentration detected was 98 times the standard, the maximum detected concentration 260 times the standard, and the upper confidence limit was 31 times the standard because the parameter was detected at two landfills and exceeded the standard at both. If additional sampling shows that alpha chlordane is detected more frequently, or exceeds the surface water quality standard at more landfills, it is recommended that the level of concern be raised to "high."

- Noteworthy parameters include beryllium, acenaphthene, 4,4'-DDE, 4,4'-DDT, dieldrin, heptachlor, heptachlor epoxide, 2,4-dimethylphenol, 2-methylphenol, and dibenzofuran. These parameters exceeded the surface water quality standards from 2.93 times (2-mehtylphenol) to 3,277 times (dieldrin), but were detected at between one and six C&DD landfills with less than half of the detections exceeding the surface water quality standards.

- Other parameters that are noteworthy include pH, cadmium and fluoride, because the concentrations detected exceeded 80 percent of the surface water quality standards.

The concentrations of the parameters in Ohio C&DD leachate that exceeded health based standards or surface water quality standards were such that discharge of untreated C&DD leachate to the environment is not lawful in Ohio.

As one example, the concentrations of the parameters in C&DD leachate exceeded the endangerment standards contained in Ohio EPA's Underground Injection Control Program rules (see paragraph (A) of OAC Rule 3745-37-07). The maximum concentrations detected exceeded the endangerment standards by as much as 80 times. The mean concentrations exceeded the endangerment standards by as much as 10 times.

As another example, the concentrations of the parameters in Ohio C&DD leachate exceeded the surface water quality standards rules found in OAC Chapter 3745-1. The maximum concentrations detected exceeded the surface water quality standards by as much as much as 2,323 times. The mean concentrations for each parameter exceeded the surface water quality standards by as much as 79 times.

The concentrations of the parameters in Ohio C&DD leachate that exceeded SMCLs were such that discharge of the leachate with maximum concentrations of parameters (exceeding SMCLs by as much as 2,323 times) or the mean concentrations of parameters (exceeding SMCLs by as much as 79 times) could render good quality ground water objectionable or unusable for consumption, washing, and industrial production without installing treatment equipment.

Two of twenty parameters were not sampled by Ohio EPA during the 2007 leachate sampling event that were identified by Ohio EPA as indicating impact to ground water from C&DD landfills in the 2008 "Hydrogeologic Evaluation of Construction and Demolition Debris (C&DD) landfills in Ohio." All of the remaining 18 parameters were detected in Ohio C&DD leachate during the Ohio EPA 2007 C&DD leachate sampling event. The presence, frequency, and concentrations of these parameters in the Ohio C&DD leachate support the plausibility of the finding by Ohio EPA that there are indications that Ohio C&DD leachate may have impacted ground water at 31 Ohio C&DD landfills.

Conclusions

The leachate from all 30 C&DD landfills had from 3 to 29 parameters with concentrations that exceeded health based standards, surface water quality standards, or both. The median was 12.5 parameters exceeding the standards. The leachate from 29 of the 30 C&DD landfills had eight or more parameters that exceeded the standards.

The highest level of concern from Ohio C&DD leachate due to health based standards is for vinyl chloride, benzene, arsenic, lead, strontium, 3-,4-methylphenol, bis(2-ethylhexyl)phthalate, boron and manganese.

The highest level of concern from Ohio C&DD leachate due to surface water quality standards is for vinyl chloride, benzene, arsenic, barium, lead, mercury, aluminum, chloride, cyanide, ammonia, sulfate, gamma chlordane, 3-,4-methylphenol, phenol, bis(2-ethylhexyl)phthalate), boron, copper, iron, manganese, phosphorus, selenium, zinc, and TDS.

A wide variety of metals and inorganic parameters were detected including heavy metals, light metals, trace elements, and other ions. A wide variety of organic parameters were detected, including pesticides, chlorinated solvents, non-chlorinated solvents, gasoline, substituted benzenes, phenolics, chlorofluorocarbons, PAHs, phthalates, substituted alkanes, and alcohols.

The wide variety of parameters detected, and the wide variation in the number and concentration of parameters that exceeded health based standards or surface water quality standards from landfill to landfill are evidence that C&DD is not harmless or inert. It is also evidence that it is difficult to predict which of the detected parameters will be present and at what concentrations at any given C&DD landfill. This is consistent with the variety of sources for C&DD that include building materials and contaminants applied to buildings and soils (such as pesticides, wood preservatives, and paints) from any type of structures including roads, bridges, residential buildings, commercial buildings, manufacturing buildings, agricultural buildings, medical buildings and laboratories, etc.

There were numerous parameters that were often detected in Ohio C&DD leachate of sufficient concentration that would violate discharge limits of Ohio rules if released to ground water or surface water. They could also cause or contribute to water pollution, and could adversely impact downgradient or downstream residential and public drinking water supplies. Of particular concern are those parameters that were found in C&DD leachate that were multiples of the health based standards (such as arsenic, boron, manganese, and lead), carcinogens (such as arsenic, vinyl chloride, and benzene), mobile in the environment (such as arsenic, vinyl chloride, and benzene), persistent in the environment (such as antimony and lead), or which bioaccumulate (such as arsenic, copper, lead, mercury, nickel, and zinc).

The concentrations of the parameters in Ohio C&DD leachate that exceeded SMCLs were such that discharge of the leachate with the average concentrations of parameters could render good quality ground water objectionable or unusable for consumption, washing, and industrial production without installing treatment equipment.

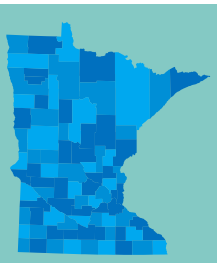
As a result, leachate from C&DD landfills poses a threat to public health and the environment if released to ground water or surface water. The threat is posed by a variety of organic parameters, metals, and inorganic parameters. The degree of risk associated with the threat by a release will be dependant upon how the C&DD was disposed, site conditions, and circumstances surrounding the site, which often change over time. This conclusion is supported by studies showing that impacts by C&DD landfills to surface water and ground water have occurred or were indicated (US EPA, Draft 1995b), (Hamilton County General Health District, 2001), (Townsend, Jambeck, & Clark, 2002), and (Ohio EPA, 2008).

Construction and demolition

October 2019

Groundwater Impacts of Unlined Construction and Demolition Debris Landfilling

MINNESOTA POLLUTION CONTROL AGENCY



Executive summary

This report is based upon self-reported data from unlined construction and demolition (C&D) landfills. The Minnesota Pollution Control Agency (MPCA) prepared this report to help inform policy discussions and possible C&D landfill rule amendments. The Request for Comments for those amendments was published on October 1, 2018 (MPCA, 2018, p. 417).

The groundwater-monitoring data on which this report is based is from wells installed in accordance with a 2005 guidance document drafted by the MPCA in consultation with C&D landfill operators ("Demolition Landfill Guidance Document" (DLGD) (MPCA, 2005). The 2005 DGLD did not change Minnesota rules or statutes; rather it established best practices based on what was then known about possible risks to groundwater. The DGLD was intended, in part, to provide data on possible effects of unlined C&D landfills on groundwater quality. Following the guidance, over time, most C&D landfills installed at least one upgradient and two downgradient groundwater-monitoring wells.

This report contains conclusions based on the analysis of self-reported data from 43 C&D landfills with adequate groundwater monitoring, spanning eight calendar years from 2010 through 2017. Three contaminants of concern (COCs) were closely evaluated for the study: Arsenic, (As), Boron (B) and Manganese (Mn). As of 2014 these COCs, and in some cases other contaminants, were being commonly detected above intervention limits (ILs) and health thresholds (HT). The data from each of the 43 C&D landfills used for this study is located here: https://www.pca.state.mn.us/waste/construction-and-demolition-landfills-groundwater

The overall design of unlined C&D landfills does not prevent the leachate from impacting the underlying aquifer. The migration of leachate into the groundwater not only introduces contamination from buried waste. In addition, through the process of oxidation-reduction reactions, it can create an environment in the groundwater that mobilizes previously stable contaminants.

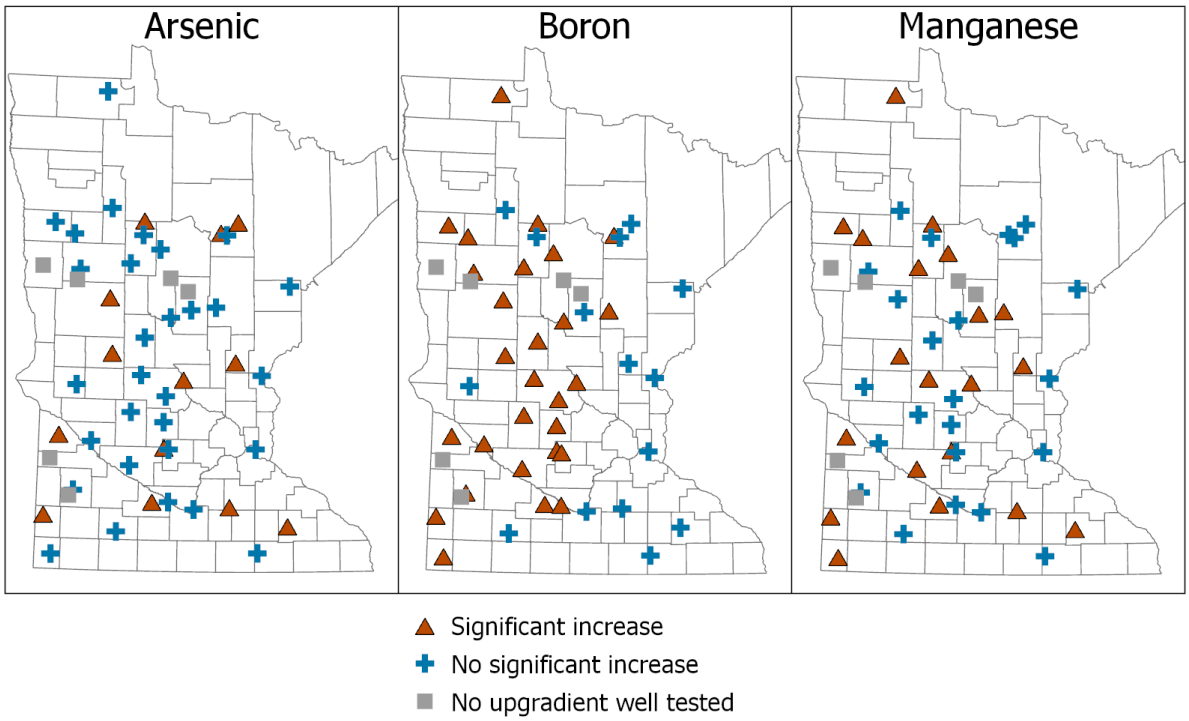
The methods and statistical basis for the results of this report are provided throughout. Overall, conclusions of the groundwater data analysis can be summarized as such:

- There is a statistically significant impact to groundwater from unlined C&D landfilling. Of the 43 landfills, 33 showed a significantly higher concentration for at least one of the three COCs (As, B, Mn) in groundwater that was downgradient of the landfill as compared to upgradient groundwater (Appendix A, Table 2). Further, occurrences of significantly higher concentrations of As, B, and Mn are not confined to particular regions of the state. Instead, they are a statewide challenge.
- **Exceedances of the contaminants of concern are above ILs and HTs.** Of the 43 C&D landfills evaluated for exceedances, 32 (74%) observed an exceedance of the IL for one or more of the COCs on at least one occasion, while 28 of them (65%) also showed an exceedance of the HT (Appendix A, Table 1).
- **Concentration trends show no evidence of improvements to groundwater.** At the 33 C&D landfills that showed a significantly higher concentration in a contaminant of concern in groundwater downgradient versus upgradient, the MPCA examined the results at individual downgradient wells for trends of the contaminants from 2010 through 2017 (Appendix A, Table 3). Eighty-four percent of the trends showed no significant statistical increase or decrease. Of those trends that did show statistical significance, there was no C&D landfill that only showed decreasing trends for the COCs.

It is important to note that while confirmed exceedances above ILs and HTs at a permitted landfill trigger a regulatory response, the issue of what to do depends on site-specific circumstances.

Additionally, another finding is that even C&D landfills attempting to accept only construction and demolition debris, as listed in the 2005 DLGD, have contaminated the groundwater to above ILs and HTs. A prime example is dissolved Boron, which measured typically low in upgradient wells and elevated in downgradient wells. Likely sources of Boron are discarded drywall and concrete, and in particular, those materials that beneficially reused coal-combustion fly ash as a replacement for Portland cement.

Figure 1. Displays the geographical distribution of C&D landfills where there was a significantly higher concentration downgradient of a contaminant. If no increase was found, they are represented in blue.



Since August 2005, there have been six construction and demolition debris disposal areas that are expansions or new areas capable of being monitored separately from other waste management or prior C&D landfills. This sub-population of landfills warranted a special assessment as they were to be operated entirely under the recommended screening procedures of the DLGD for all waste disposed at the disposal areas. Of the six C&D landfills in this sub-group, two were not included in the report. One was due to the landfill having a liner and leachate collection system installed and the other has yet to landfill any construction and demolition debris. Of the remaining four post-2005 C&D landfills, three (75%) have observed exceedances of both the IL and the HT for one or more of the COCs. This sub-population does contain the only landfill to report no exceedances of the IL for any of the COCs.

CONSTRUCTIONDIVE

BRIEF

Report: Global construction waste will almost double by 2025

By Kim Slowey

Published March 13, 2018

Dive Brief:

- The volume of construction waste generated worldwide every year, according to a report from Transparency Market Research, will nearly double to 2.2. billion tons by the year 2025, according to Construction & Demolition Recycling.
- Construction waste as classified in the report includes materials from excavation, roadwork and demolition, as well as complex waste like plastics, metal, ceramic and cardboard. Making up more than half of the construction waste generated annually are building materials including wood, shingles, asphalt, concrete and gypsum.
- According to the study, "reduce, reuse and recycle" policies are necessary to control the amount of construction waste, but insufficient resources, lack of standardization, slim profit margins, policy apathy and lack of education on the issues are keeping that from happening. The Asia Pacific region is expected to generate a majority of the construction waste in the year to come, followed by North America. Europe, according to the report, has developed the best construction waste management technologies.

Dive Insight:

The disposal of construction waste is often a safety issue. In December 2015, a pile of construction debris caused a landslide in Shenzhen, China that killed more than 70 and left 900 individuals displaced. The slide also demolished a host of buildings, including 33 factories, workers' living quarters and apartments.

Because of the construction boom in the area, the Chinese government had set up more than 10 dump sites for the resulting debris, but, reportedly, at this location, the pile of excavated dirt and material waste was too high and became unstable. Some analysts, according to The New York Times, blamed the landslide on China's building boom and the unwillingness on the part of local officials to enforce regulations regarding the disposal of construction debris.

In the U.S., officials in Texas are struggling with how to handle the waste created by Hurricane Harvey in the Houston area last year, according to Waste Today. The Federal Emergency Management Agency has said the area will take years to clean up, and the Texas Commission on Environmental Quality has waived some solid waste disposal regulations – air quality, emissions, wastewater and hazardous waste storage – in order to hasten the process.

In Minnesota, construction debris is impacting groundwater, according to the Bristol Herald Courier. Because construction waste in landfills isn't included in the state's solid waste rules, the Minnesota Pollution Control Agency (MPCA) is pushing for tougher standards for demolition landfills that provide no barrier between deposited materials and groundwater. However, county officials across the state are pushing back against proposals to tighten regulations until the agency can pinpoint what exactly is contaminating groundwater.

Recommended Reading:

07/10/2017 Policy Learning Platform

Construction and demolition waste

Construction and demolition waste (CDW) accounts for approximately 25% - 30% of all waste generated in the EU. This type of waste contains materials with high resource value such as metals, wood, glass, concrete, etc. Therefore, there is a high potential for recycling and material recovery of CDW which so far is under-exploited. The EU waste legislation aims to shift the management of various waste streams, including CDW, outlining a waste management hierarchy: from prevention, to re-use, recycling, recovery and disposal.

The Waste Framework Directive, along with other EU waste directives – on landfilling, end-of-life vehicles, e-waste, batteries, packaging waste, etc., includes specific targets to stimulate recycling. With regards to CDW, by 2020, 70% of non-hazardous construction and demolition waste (by weight) has to be recycled or recovered. The EU highlighted the importance of CDW in the Circular Economy Package which lays out Europe's path towards a circular economy and increased competitiveness. CDW is one of the five priority areas which the Circular Economy Package addresses.

Another step forward is the EU Construction and Demolition Waste Protocol, introduced in November 2016, which contains the first guideline about CDW management. The Protocol links with the Construction 2020 strategy, and with the Communication on Resource Efficiency Opportunities in the Building Sector. The Protocol contains good practices from across the EU that can serve as source of inspiration for policy makers and practitioners. It also includes an overview of definitions and a checklist for practitioners. Target groups of the guidelines are local, regional and national authorities, industry practitioners; construction sector, waste

treatment, transport and logistics as well as recycling companies and others. The Protocol also clearly states that, beside improved waste management practices, clear and strong policy and framework conditions are of key importance to increase the recycling rate of CDW.

The level of recycling varies significantly – from 10% to 90% - between the Member States, showing that lower performing Member States can certainly improve by applying good practices from the ones with the highest recycling rates. The potential to increase construction sector resource efficiency by increasing CDW recycling rate is significant.

One possible policy tool to increase the recycling rate of CDW is Green Public Procurement (GPP). As part of GPP, a selection criteria can be introduced for recycling quotas in materials used for construction and sorting requirement for CDW. The Interreg Europe GPP4Growth project aims to address the challenges and exploit the possibilities related to the adoption of the new EU public procurement system, effective since April 2016. GPP4Growth supports the creation of new opportunities for public authorities to stimulate eco-innovation, resource efficiency and green growth, mostly by using new award criteria in calls and tenders that pay particular attention to environmental considerations.

Type: Platform

Tags: #policylearning, environment and resource efficiency, construction, waste, EU

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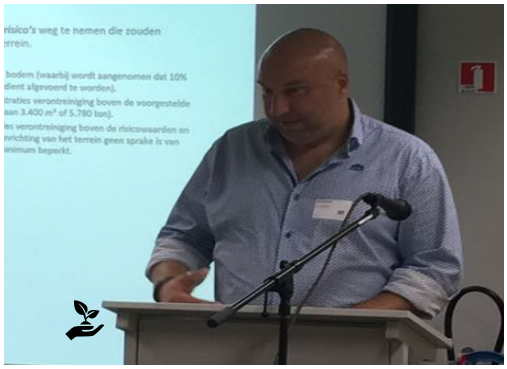

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Environmental and economic impact assessment of construction and demolition waste disposal using system dynamics

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ABSTRACT

Construction and demolition wastes (CDW) have increasingly serious problems in environmental, social, and economic realms. There is no coherent framework for utilization of these wastes which are disposed both legally and illegally. This harms the environment, contributes to the increase of energy consumption, and depletes finite landfills resources. The aim of this paper is to evaluate the impacts of two alternatives for the management of CDW, recycling and disposing. The evaluation is carried out through developing a dynamic model with aid STELLA software by conducting the following steps: (1) quantifying the total cost incurred to mitigate the impacts of CDW landfills and uncollected waste on the environment and human health; (2) quantifying the total avoided emissions and saved energy by recycling waste; (3) estimating total external cost saved by recycling waste and; (4) providing a decision support tool that helps in re-thinking about waste disposal. The proposed evaluation methodology allows activating the stringent regulations that restrict waste disposal and developing incentives to encourage constructors to recycle their wastes. The research findings show that recycling CDW leads to significant reductions in emissions, energy use, global warming potential (GWP), and conserves landfills space when compared to disposal of wastes in landfills. Furthermore, the cost of mitigating the impact of disposal is extremely high. Therefore, it is necessary to recycle construction and demolition wastes.

1. Introduction

The construction/demolition industry is considered one of the largest producers of solid wastes globally. The huge amount of construction and demolition wastes (CDW) has been generated from increasing the building of new structures, renovation, rebuilding, repair, demolition works, and infrastructure development projects. Large quantities of construction and demolition wastes (CDW) cause harmful effects on the environment if they are not managed in proper manner. As such, these huge amounts of wastes need to be properly managed. The current situation of waste management in Egypt lies in disposed waste either legally or illegally and there is no coherent framework for making the most of these wastes. It is very important to give priority to the environment in addition to conventional project objectives, such as cost, duration, quality and safety (Liyin et al., 2006). Thinking about waste management from a limited perspective gives rise to some economic concerns. This is because a large amount of money is spent on dumping the waste in landfills and mitigating the effects of dumping on the environment. The environmental problems include: (1) diminishing landfill space due to incremental quantities of these disposed wastes in it; (2) the depleted building materials; (3) the increase in contamination from landfills that lead to serious negative health effects; (4) damage to the environment; and (5) the increase in energy consumption for transportation and manufacturing new materials instead of those materials dumped and which require energy production. The later problem is attributed to the loss of embodied energy of the disposed wastes that can be used to produce new construction materials. It is worth noting that CDW recycling saves the embodied energy in waste materials by the replacement of virgin raw materials with recycled materials (Roussat et al., 2009). Therefore, energy savings are often the driving force behind emissions savings (Choate et al., 2005).

CDW are adding to the phenomenon of global warming. Hotter temperatures due to Global Warming Potential (GWP) lead to increased weather extremes including heat waves and worsening of air quality. Epidemiological studies of deaths during the heat waves refer to the fact that a substantial portion of the mortality might be attributed to elevated ozone and particulate levels that occurred during the heat waves (American lung Association, 2004). The California Air Resources Board indicated that the health effects of increasing concentrations of particulate matter and ozone are: 6500 premature deaths, 4000 hospital admissions for respiratory disease, 3000 hospital admissions for cardiovascular disease, 350,000 asthma attacks, 2000 asthma-related emergency room visits, elevated school absences due to respiratory conditions,

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What's Up With the Gulf

Tuesday, May 10, 2011

Greener plan for Saufley landfill pitched | Pensacola News Journal | pnj. com

Greener plan for Saufley landfill pitched | Pensacola News Journal | pnj.com: "Greener plan for Saufley landfill pitched"

Greener plan for Saufley landfill pitched
Local company says it can clean site safely, affordably

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Written by
Jamie Page
jepage@pnj.com Filed Under
News
Local News
A chemist puts black, oil-saturated sand into a glass beaker, adds water and a clear plant-based cleaner, and swirls the now jet-black water.

Within minutes the sand becomes visibly clean and the oil eventually separates from what is seemingly clear water.
The demonstration held Monday in a University of West Florida laboratory holds promise that the same industrial technology can clean debris, soil and contaminated groundwater at Saufley Field Landfill and avoid taking most of the waste to an expensive lined landfill, says Bio Blend Technologies.
The Cantonment-based company, which conducts its research and development at UWF, also says its processes can be done at a significantly lower cost than Escambia County would spend hauling all removed Saufley debris to the county's lined Perdido Landfill.
That's the county's current plan for cleaning up Saufley, an abandoned, mismanaged construction and demolition debris (C&D) landfill that the Florida Department of Environmental Protection has said is contaminated.
The original plan was to haul Saufley material that "appears to be" C&D debris to other C&D pits, such as Rolling Hills or Longleaf C&D landfills.
But after the News Journal wrote a story about how residents in those communities planned to fight the decision because they feared their groundwater would become contaminated from the waste, commissioners voted unanimously to send all Saufley waste to a lined landfill.
"The people who live around Saufley can assure you that what they saw go in Saufley Landfill was unimaginable, things like refrigerators and air conditioners where Freon could have leaked into the ground. They said caskets were put in there, medical waste and materials from old buildings that may have had asbestos in it," said Commissioner Wilson Robertson, whose district includes Saufley.
Robertson, last week, moved for all waste removed from Saufley to go to Perdido Landfill.
"So, we have committed to taking it all to a lined landfill," he said. "But with this technology, if the Department of Environmental

Protection is on board and there is a better way to do this, we are open to considering it. Safety is number one here."

Bio Blend representatives made the lab presentation to show a group of elected officials, engineers, environmentalists and others stakeholders how its plant-based liquids work in hopes of eventually getting a county contract to clean up Saufley.

After seeing the presentation, Robertson said he would be open to allowing the company to meet with county engineers and create a small test site at Saufley Landfill to determine whether the technology could work there.
The Bio Blend cleaners can leave the water they clean in drinkable condition, meaning the water can be reused, said David O'Neill, president/CEO of Bio Blend Technologies.
Roger Kubala, COO of the company, also claims the product can clean the contaminated groundwater wells and contaminated soil at Saufley in an environmentally green way.
As proposed, Bio Blend also would use another of O'Neill's Cantonment-based companies, Enviro Pro Tech, for the landfill cleanup.
EPT uses a trommel machine that takes a mixture of things like wood, concrete, metals and dirt, and grinds, screens and separates them into separate piles by material for recycling. As the debris is fed through the machine it is sprayed with a Bio Blend cleaner that its makers say will remove all contaminants and leave no harmful by-products.
EPT currently provides environmental monitoring services to Rolling Hills C&D Landfill, the only C&D pit in the county that recycles construction waste.
State Sen. Greg Evers, R-Baker, also attended the presentation, where he said he would like to see the Saufley mound brought down to ground level if state and U.S. Navy funds are available to assist with it. And Robertson agrees.
Currently, the plan is to take off 20 to 30 feet of the top of the 58-foot mound.
Evers favors the Bio Blend/EPT method of dealing with Saufley's waste.
"I don't care where the waste is taken, but if we are concerned about people's health and the odor that is going to be generated out there, well, if they want to use something to actually break down the contaminants then that's great," Evers said.

"But I have a problem with just hauling off the raw contents from the landfill without treating it and trying to be as safe as possible."

Bio Blend used its technology to clean up an active gas station in Escambia County. After 30 years as a gas station, it had contamination from three underground storage tanks and dispensers that occurred prior to 1996.
The gas station owner first tried a different remedial cleanup method starting in July 2002, and after four years had limited results.
Then Bio Blend was hired and after 77 days of treatment, nearly 99 percent of the contamination was removed and the gas station continued operating during the cleanup, O'Neill said.
The cost was $575,000 compared to $1.2 million spent using the previous unsuccessful method, O'Neill said.
It's unclear whether the product has DEP's approval. The county's DEP representative who inspected Bio Blend's work at the local gas station could not be reached for comment.
Bio Blend said its process also could be used to clean up the BP oil spill.

DEPARTMENT OF ECOLOGY
State of Washington

Waste	Where / Why	Waste Code
Absorbent materials, see Shop Towels	Absorbents contaminated with dangerous waste become dangerous waste.	Code depends on materials absorbed
Aerosol cans	Propellant is most likely ignitable, and the product may be dangerous waste.	Char: D001, D003,Test to determine the waste code of contents
Asbestos-containing Materials	Asbestos can lodge in the lungs and cause serious problems... older types of floor tile, insulation, or other materials	
Empty Containers/ Drums		
Lead-containing materials	Siding or drywall with lead paint, lead flashings, lead in plumbing & pipes	D008 or recycle as scrap metal without codes
Mercury-containing light Bulbs/lamps (Fluorescent bulbs)	Bulbs and tubes can be characterized as toxic, due to mercury, but they can be handled as a universal waste. (See Universal Waste.)	Not needed, if handled as Universal Waste
Mercury-containing Thermostats	Thermostats can be characterized as toxic, due to mercury, but they can be handled as a universal waste. (See Universal Waste.)	Not needed, if handled as Universal Waste
Mercury-containing switches and relays		
PCB-Containing Light Ballasts	Ballasts listed with PCB concentration of ≥ 2 parts per million	WPCB
Paint, waste or expired, oil-based	Waste paints, varnish, solvents, sealers, thinners, resins, roofing cement, adhesives, machinery lubricants, and caulk. Ignitable if flash point is below 140°F State-only waste, often, due to metal content.	D001
Sludge or "bottoms" from solvent still that recycles gun cleaner or thinner	Listed and often ignitable waste: Still bottoms from a still where the solvent blend contains, before use, 10% or more of solvents such as, toluene, and MEK. The mixture also has a flash point below 140°F.	Listed: F005 Char: D001
Waste methylene chloride paint stripper (unused)	Listed waste: The discarded material is a commercial chemical product listed for toxicity.	Listed: U080

See Solvents.		
Waste methylene chloride paint sludge stripped from buildings. See Solvents.	Listed waste: The solvent blend contains, before use, 10% or more of methylene chloride.	Listed: F002
Waste gun-cleaning solvent See Solvents.	Listed and ignitable waste: The solvent blend contains, before use, 10% or more of solvents such as, toluene, and MEK. The mixture also has a flash point below 140°F.	Listed: F005Char: D001
Waste paint thinner See Solvents	Listed and ignitable waste: The solvent blend contains, before use, ten percent or more of solvents such as, toluene, and MEK. The mixture also has a flash point below 140°F.	Listed: F005 Char: D001
Shop Towels/Rags Contaminated with Dangerous Waste	Absorbents soaked with dangerous waste become dangerous waste. However, non-dripping rags/ towels are not considered dangerous waste if they are: • Laundered at an appropriate facility • Stored in containers away from a source of ignition AND • Not mixed with other waste.	Code depends on materials absorbed. Not needed if properly laundered.
Sanding dust	Sometimes characteristic-toxic, if dust is from older buildings.	Test to determine waste code.
Treated wood	lumber, posts, ties, or decks, and utility poles	

Direct from ATSDR

Michelle Colledge, M.P.H., Ph.D.
Lynn Wilder, M.S.Hyg., C.I.H.

Construction and Demolition (C&D) Landfills: Emerging Public and Occupational Health Issues

Editor's note: As part of our continuing effort to highlight innovative approaches to improving the health and environment of communities, the Journal *is featuring a bimonthly column from the U.S. Agency for Toxic Substances and Disease Registry (ATSDR). The ATSDR, based in Atlanta, Georgia, is a federal public health agency of the U.S. Department of Health and Human Services. ATSDR serves the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances.*

The purpose of this column is to inform readers of ATSDR's activities and initiatives to better understand the relationship between exposure to hazardous substances in the environment and its impact on human health and how to protect public health. We believe that the column will provide a valuable resource to our readership by helping to make known the considerable resources and expertise that ATSDR has available to assist communities, states, and others to assure good environmental health practice for all served.

The authors of this month's installment, Michelle Colledge and Lynn Wilder are with ATSDR's Division of Regional Operations and Division of Health Studies, respectively. Dr. Colledge is a senior research officer, and earned her MPH from Florida A&M University and her Ph.D. from the University of Illinois at Chicago School of Public Health. She is a lieutenant commander in the United States Public Health Service, and has worked for ATSDR since 1999. Since working in the region 5 office, Michelle has lead multi-agency and multi-disciplinary teams in public health investigations, risk and exposure assessment, and provides technical assistance to partner agencies for emergency response activities. Lynn Wilder is a senior environmental scientist and received her M.S. in industrial hygiene from the University of Pittsburgh. She is a certified Industrial Hygienist and is a Ph.D. candidate at the University of Washington's Department of Environmental and Occupational Health. Since joining ATSDR in 1989, she has worked in areas of emergency response, health and exposure investigations, and health studies.

Historically, construction and demolition (C&D) debris landfills have been considered nonhazardous operations, containing relatively inert wastes such as concrete, asphalt, wood, metals, gypsum drywall, and roofing materials. In recent years, however, it has become increasingly clear that emissions resulting from the decomposition of gypsum drywall and organic debris are a public health issue. Drywall, comprised of gypsum ($CaSO_4 \bullet 2H_2O$), breaks down into hydrogen sulfide and other sulfur compounds under anaerobic conditions and in the presence of water. When exposed to water, the sulfate in the gypsum is dissolved in landfill leachate (Townsend, 1998). Under the same environmental conditions, organic debris degradation produces other flammable gases such as methane. As a result, surface and subsurface fires may occur at C&D landfills (Federal Emergency Management Agency [FEMA], 2002).

Drywall can be a significant constituent of C&D wastes. Depending on the type of construction, it comprises between 5% and 25% of total C&D volume generated (Townsend et al., 2000; United States Environmental Protection Agency [U.S. EPA], 1998). In the United States, C&D waste comprises a considerable portion of the overall solid waste stream. The U.S. Environmental Protection Agency (U.S. EPA) estimated that over 136 million metric tons of building-related wastes were generated in 1996 (U.S. EPA, 1998). Approximately 35%–40% of these wastes were landfilled in C&D facilities. As a comparison, this amount of C&D waste was only slightly less than the 190 million metric tons of total municipal solid waste (MSW) generated that same year (Clark, Jambeck, & Townsend, 2006). In 1996, approximately 1,900 C&D landfills were operating in the United States (U.S. EPA, 1998). At these sites, gas emissions to ambient air are influenced by a number of factors, including, but not limited to, the volume and composition of the waste (particularly gypsum drywall content); engineering design and controls; the condition, composition, and thickness

of the landfill cap; and leachate collection, removal, and handling practices.

Because U.S. EPA does not specifically regulate the operations of C&D landfills, C&D regulation is the responsibility of individual states. Clark and co-authors (2006) recently reviewed and summarized state C&D landfill regulations across the country. The authors found little consistency from state to state in the siting and engineering design requirements of these facilities, in regulatory oversight and rules, or even in a state's definition of what constitutes C&D waste. The authors did find, however, that state standards are generally far less stringent for C&D facilities than for MSW facilities (Clark, Jambeck, & Townsend, 2006).

The Agency for Toxic Substances and Disease Registry (ATSDR) and its federal, state, and local health and environmental agency partners have recently investigated a number of C&D landfills with gas emissions that caused significant community health concerns. Community exposures vary, but are generally greatest during stable meteorological conditions and are generally diurnal with the highest concentrations in ambient air in late evening and early morning hours. At some of these sites, concentrations of hydrogen sulfide gas in residential ambient air were at or above levels known to cause adverse human health effects. At an Ohio C&D landfill, hydrogen sulfide concentrations in residential ambient air approached the National Institute of Occupational Safety and Health (NIOSH) recommended exposure limit (REL) for the occupational ceiling value of 10 parts per million (ppm) (ATSDR, 2003). Improper leachate management at the same site also resulted in community hydrogen sulfide concentrations of up to 95 ppm on at least one occasion (ATSDR, 2006). This concentration is just below the NIOSH immediately dangerous to life and health (IDLH) level of 100 ppm over 15 minutes.

Under normal conditions, hydrogen sulfide is a colorless, flammable gas. It has an odor threshold as low as 0.5 parts per billion (ppb) (ATSDR, 2006), and is typically characterized as smelling like rotten eggs or sewage. When inhaled, hydrogen sulfide readily enters the blood stream via diffusion through pulmonary alveoli. The majority of hydrogen sulfide is metabolized through oxidation into thiosulfate, then further oxidized to sulfate, which is rapidly excreted in the urine. People with preexisting respiratory conditions or immature respiratory systems are more likely to experience adverse health effects from hydrogen sulfide exposure. Those with cardiac or nervous system disorders may also be more likely to experience adverse outcomes from hydrogen sulfide exposure. Although the exacerbation of preexisting respiratory conditions (e.g., asthma) and neurological effects (e.g., headache, nausea, and fatigue) have been noted at low levels (between 10 and 100 ppb), to date, quantifiable irritant effects levels have only been reported with exposures in the low ppm range (Bhambini, Burnham, Snydmillar, MacLean, & Lovlin, 1996a, 1996b; Campagna et al., 2004; Jappinen, Vilkka, Marttila, & Haahtela, 1990; Kilburn & Warshaw, 1995; Kilburn, 1997; Kilburn, 1999). With acute exposures at concentrations at or above 100 ppm, serious injury and death are possible (Hirsch & Zavala, 1999; Milby & Baselt, 1999; Parra, Monso, Gallego, & Morera, 1991; Reiffenstein, Hulbert, & Roth, 1992; Snyder, Safir, Summerville, & Middleburg, 1995; Tvedt, Edland, Skyberg, & Forberg, 1991; U.S. EPA, 2003).

Although ATSDR is not an occupational health agency, staff members have noted worker health and safety issues at numerous C&D landfills. Generally, these facilities have no employee training programs on the use of personal protective equipment and no onsite monitoring programs for common C&D gases. In one case, several employees either lost consciousness or became nauseated and evacuated the work area (Florida Department of Health [FDOH], 2007). In November 2007, four employees died as a result of exposure to high concentrations of hydrogen sulfide while attempting to repair a leachate pump at a C&D landfill in Superior, Wisconsin (Einhorn, 2007). Surface and subsurface fires at C&D landfills also pose a physical hazard to site employees.

The removal of drywall from the waste stream would reduce the potential of hydrogen sulfide generation from C&D facilities. Drywall recycling is an emerging market, and has the potential to significantly diminish the quantity of drywall going into C&D landfill facilities and reduce the potential of human health effects from exposure. Most drywall waste is generated from new construction (64%), followed by demolition (14%) (California Integrated Waste Management Board [CIWMB], 2008). Scrap from new construction is the primary focus of today's drywall recycling market, but future recycling strategies may also include recycling demolition drywall wastes (Townsend, 2003).

Weak regulations that govern C&D facilities at the state and local levels make addressing exposures at these sites an onerous and complicated process. Also, in the absence of a federal ambient air quality standard for hydrogen sulfide, many states have promulgated their own hydrogen sulfide standards—but others have not. Without these kinds of standards, requiring changes in facility operations that lead to reductions in community exposures is difficult at best.

The issues of national consistency and the potential for adverse effects on human health necessitate a dialogue about how best to manage C&D debris while minimizing its effects on neighboring communities. When health issues arise, it is challenging for some states to protect human health from the consequences of inadequate C&D management. Negative public health impacts would be avoided if more careful consideration was given to C&D landfill siting, design, management, and closure. Such an approach would protect health and quality of life for neighboring residents and employees.

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Health Consultation

Hydrogen Sulfide in Ambient Air

COYOTE CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL

HOLLEY NAVARRE, SANTA ROSA COUNTY, FLORIDA

SEPTEMBER 30, 2008

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Summary

In this report, the Florida Department of Health (DOH) reviews hydrogen sulfide air levels near the Coyote Landfill. Between late January and early March 2007, the Santa Rosa County Health Department (CHD) tested the air outside one home just south of this landfill and requested Florida DOH review the results.

After the 2004 and 2005 hurricanes, the Coyote Landfill accepted large volumes of construction and demolition debris including drywall (also known as wallboard or sheet rock). When drywall and other landfill wastes decompose, they generate odors and gases. Decomposing drywall produces hydrogen sulfide gas, which has a characteristic "rotten egg" odor. Because landfill decomposition produces heat, hydrogen sulfide and other landfill gasses can ignite resulting in frequent surface and sub-surface fires.

In July and August 2006, Santa Rosa CHD staff surveyed over 200 residents living within 2 miles of the Coyote Landfill for signs of illness. People closer to the landfill complained more often of respiratory problems, eye/nose/throat irritation, headaches, nausea and other symptoms. Residents associated these symptoms with landfill odors and with smoke and odors from the October and November 2005 surface fires, which were reported to cause more and greater symptoms. Santa Rosa CHD staff advised residents with respiratory symptoms to seek medical care, remain indoors, or leave the area if their symptoms became intolerable. They also supplied hydrogen sulfide indoor air filters to 23 nearby residents. A group of concerned citizens, the Holley Action Group, applied for a grant to buy 24 air filters for residences. According to the group, these air filters were not available until two years after residents had begun complaining of hydrogen sulfide exposures. The Florida DOH bought 10 additional air filters in December 2007, which the Holley Action Group distributed to homes with small children or senior citizens with health problems.

The Florida DOH classifies past and current exposures to air near the Coyote Landfill as a "public health hazard". Concentrations of hydrogen sulfide measured in the air south of the Coyote Landfill between January 29 and March 2, 2007 could have adversely affected children with respiratory-diseases and could have caused eye irritation, nasal irritation, cough, breathlessness/wheezing, and headaches in children and adults. Although levels of air-borne particulates (smoke) from the landfill fires were not measured at that time, smoke could also have aggravated symptoms in people with preexisting respiratory conditions.

Studies comparing communities near paper mills, refineries and animal feedlots that emit hydrogen sulfide along with other chemicals, with communities that do not smell hydrogen sulfide and other odors have shown significantly higher rates of psychological symptoms such as tension, depression, and fatigue in the odor-exposed groups than in the control groups. The Protocol for Assessing Community Excellence in Environmental Health (PACE-EH) informal community health survey showed 20 to 30 % of the survey respondents had symptoms of fatigue, restlessness, and sleeplessness, and between 11 and 18% reported dizziness, inability to concentrate, nervousness, and feelings of confusion.

The Florida DOH recommends:

- Reducing residential exposures to hydrogen sulfide from the Coyote Landfill as soon as possible. Nearby residents should report any odors or smoke to Santa

Rosa CHD and Florida Department of Environmental Protection (DEP), Northwest District Office.

- Continuing real-time monitoring for hydrogen sulfide around Coyote Landfill to ensure levels are below those of public health concern. If site perimeter values exceed those of public health concern, a contingency plan should be developed for monitoring in residential areas and stopping the source of hydrogen sulfide emissions. Nearby residents should stay inside or leave the area based on the level of irritation or symptoms they are experiencing due to hydrogen sulfide exposure. Persons who feel ill, especially those with persistent symptoms, should see their doctors. They should tell their doctors about any concerns they might have about environmental exposures.
- Reducing the threat of landfill fires and other sources of odors or chemical releases.
- Continuing to restrict landfill access.

According to recent Florida Department of Environmental Protection (DEP) site inspection reports, the Coyote Landfill operators moved debris from surface water, covered smoldering areas with soil, and have begun covering the active dumping areas (working faces) with soil on a weekly basis.

Purpose

The Florida Department of Health (DOH) evaluates the public health significance of environmental contamination sources through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). Florida DOH evaluated hydrogen sulfide air monitoring data collected by the Santa Rosa County Health Department (CHD) at the Coyote Landfill in Holley-Navarre. This report evaluates the potential for hydrogen sulfide emissions from the landfill to affect the health of nearby residents based on the results of hydrogen sulfide monitoring from January 29, 2007 to March 2, 2007. U.S. Environmental Protection Agency conducted subsequent residential air sampling for hydrogen sulfide in November/December 2007 and January/February 2008. These data have been evaluated by Florida DOH. The results are similar to those found with the data collected by the CHD. Florida DOH will release a separate health consultation about the more recent data.

Background

Coyote Landfill occupies 37 acres at 3201 Five Forks Road, in a rural area off Avery Olsen Road north of Navarre, Santa Rosa County, Florida (Figure 1). Eighteen acres of the site were developed as a borrow pit prior to 1980 (Brown, Burdine & Associates 2006). The Florida Department of Environmental Protection (DEP) permitted those 18 acres as a construction and demolition debris landfill beginning in 1987. In 1998, site debris occupied about 6 acres, and K&K Construction Group permitted the site as Kevin Jernigan C&D Landfill, Inc. Coyote Land Company purchased the 18.8-acre landfill site in 2001 and applied for a transfer of the prior C&D permit. Coyote purchased 19 adjacent acres to complete the acreage of the present property and expanded the permit for the landfill to include the entire property in 2004.

In 2000, over 300 people lived within a 1-mile radius of the landfill. Approximately 95 % were white, and 5 % percent were American Indians, Hispanics, or Asians. Much of the area is rural

FEATURES

Construction and Demolition Debris Landfills: Community and Occupational Health Issues

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Introduction

There is a need to raise awareness of the community and occupational health issues associated with construction and demolition (C&D) debris landfills. C&D debris includes materials from building demolition, renovation, new construction, and disaster-related waste such as post-hurricane wastes. These materials were once thought to be inert. However, health agencies are becoming increasingly aware of the potential community exposures and health risks from C&D landfill contaminants. The exposure concerns include: 1) inhalation of hydrogen sulfide and other sulfur gases emitted from the landfill; 2) inhalation of smoke and dust from surface and subsurface fires; 3) inhalation of dust from vehicle traffic, and 4) ingestion of contaminated private well water from landfill leachate. In addition, unrestricted public access onto landfills can result in physical injury. Depending on state and local regulations, correcting problems once they occur is potentially difficult. The following is a summary of C&D issues meant to raise the awareness of the Florida health officials, the medical community, and state and local governments. Recommendations are made that may prevent or reduce the impact of these landfills on public and worker health and safety.

Regulations: There are no federal regulations that apply to C&D landfills. State-based regulatory requirements for these facilities vary widely from state to state [1]. In Florida, permits for new C&D landfills are reviewed and approved by the Florida Department of Environmental Protection (Florida DEP). The location of landfills are approved by county governments and elected officials. Florida DEP C&D facility requirements include operator training, waste screening, groundwater monitoring, and height/slope restrictions upon closure of the facility, Closure regulation requirements include covering the landfill with 2 feet of material, construction of a surface water runoff collection system, and continued groundwater monitoring for a 5-year period. Although part of the state recommended management practices, Florida regulations do not require landfill liners, leachate collection and treatment systems, gas extraction or treatment systems, or air monitoring. [2]. In March, 2005, 112 C&D facilities were located in Florida [3].

Contaminants of concern at C&D landfills: One of the materials accepted at C&D landfills is wallboard or gypsum drywall. When gypsum drywall is exposed to water, the calcium sulfate component dissolves. As conditions in the landfill become anaerobic (without oxygen), sulfate reducing bacteria digest the sulfate and release hydrogen sulfide [4]. Lower levels of other sulfur compounds (e.g., mercaptans, carbonyl sulfide) are also produced. Exposure to these other sulfur compounds is also a public health concern; however, hydrogen sulfide is emitted at much higher levels and is therefore of greater concern. Methane gas is also produced under the same anaerobic conditions by other bacteria as they degrade organic material in the landfill. All of these processes are exothermic (heat-generating). Hydrogen sulfide, the other sulfur compounds, and methane are all flammable gasses. When gases build up to flammable concentrations, both surface and underground fires can result. Inhalation of particulate matter from smoke and dust from trucks and other construction vehicles (e.g., excavators, loaders) impacts those with cardiac or pulmonary health problems.

Contaminants typically found in groundwater surrounding C&D landfills include cadmium, lead, iron, manganese, several chlorinated volatile

organic compounds, and sulfate. Elevated levels of chromium and arsenic are found if chromated copper arsenate-treated wood is disposed of in the landfill [5]. These contaminants can reach levels that exceed the U.S. Environmental Protection Agency's (EPA) primary and secondary drinking water standards. Contaminated groundwater has the potential to migrate to private wells used for drinking water.

Overview on hydrogen sulfide and health effects: Hydrogen sulfide has an odor similar to rotten eggs. It is a colorless gas that is heavier than air. People can smell hydrogen sulfide at concentrations beginning in the low parts per billion (ppb) range. At concentrations of 10 parts per million (ppm) or higher people can no longer smell the gas due to olfactory fatigue (inability to detect hydrogen sulfide odors) [6]. In the U.S., an average of 0.11 to 0.33 parts per billion (ppb) is found in the air. In undeveloped areas, levels range between 0.02 and 0.07 ppb [7].

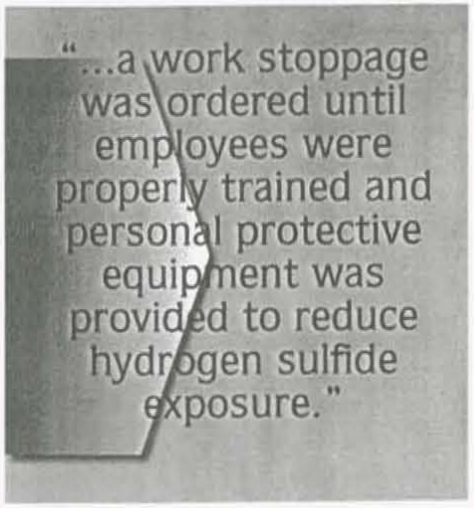
Occupational Exposures: Exposure to hydrogen sulfide at 50 to 100 ppm can cause conjunctivitis and respiratory irritation after one hour. Short-term exposure to high concentrations (170 to 300 ppm) of hydrogen sulfide is the maximum occupational concentration endurable for one hour without serious consequences [8]. Exposure above 500 ppm results in unconsciousness and death [9]. The National Institute for Occupational Safety and Health (NIOSH) has an immediately dangerous to life and health (IDLH) value of 100 ppm based on acute inhalation of hydrogen sulfide. The IDLH is defined as the ability of a worker to escape an area without loss of life or irreversible health effects [10]. The NIOSH occupational 40-hour permissible exposure value and the 10-minute ceiling value for this gas is 10 ppm [11]. The American Conference of Governmental Industrial Hygienists 40-hour work week exposure guidance value is 10 ppm, with a 15 minute ceiling value of 15 ppm [12]. The Occupational Safety and Health Administration (OSHA) permissible exposure limit is 20 ppm with a maximum (10 minute) peak exposure value of 50 ppm [13].

Community Exposures: Hydrogen sulfide in air affects the eyes, lungs, and nervous system. People with pre-existing respiratory problems (e.g., asthma and restrictive lung disease), children, and the elderly are more sensitive to adverse health effects from exposure to mucous membrane irritants such as hydrogen sulfide. In addition, persons with cardiac or nervous system disorders are more susceptible to the effects of hydrogen sulfide [7]. More recent studies indicate that exposure to low levels of hydrogen sulfide may result in adverse health effects. One study found an association between children's unplanned asthma-related hospital visits and days with hydrogen sulfide levels above 0.03 ppm for 30 minutes or more [14]. A controlled exposure study (0.05 ppm, 0.5 ppm, and 5 ppm for 3-hour durations) found increased anxiety in healthy young adults significantly associated with self-reported olfactory irritation. In this study, all three exposure concentrations affected verbal learning [15].

The American Industrial Hygiene Association's most conservative Emergency Response Preparedness Guideline (ERPG) for hydrogen sulfide is 0.10 ppm. The ERPG is defined as the maximum 1-hour airborne concentration below which nearly all individuals do not perceive a clearly defined objectionable odor [16]. ERPGs are used to make shelter-in-place or evacuation decisions during a chemical release. They are not intended for repeated exposure situations from a stationary source such as a C&D landfill. The Agency for Toxic Substances and Disease Registry's (ATSDR) acute minimal risk level (MRL) is 0.07 ppm for hydrogen sulfide. This MRL is defined as a 2-week exposure value. The intermediate (>14-364 days) MRL is 0.02 ppm. Exposures below the MRL are not expected to result in non-cancerous health effects [7].

On-site hydrogen sulfide contaminant levels and occupational health and safety risks: The University of Florida (UF) conducted extensive air sampling within and near the surface at several C&D landfills [4]. Surface testing for hydrogen sulfide across 10 landfills found hydrogen sulfide levels from below the lower limit of detection (0.003 ppm) to greater than the upper detection limit (50 ppm). Average hydrogen sulfide levels ranged from 0.003 ppm to greater than 4 ppm. Methyl mercaptan, carbonyl sulfide, and carbon disulfide were frequently detected, but at much lower levels than hydrogen sulfide. Methane was found in 45% of the samples collected, with levels up to 47.5% (by volume).

In 2005, EPA conducted on-site air sampling for hydrogen sulfide at 50-foot intervals on a C&D landfill in Trumbull County, Ohio. Levels detected ranged from less than 0.001 ppm up to 165 ppm [17].



In early 2007, a consultant for a C&D landfill in Escambia County, Florida, conducted hydrogen sulfide air sampling in the landfill work areas [18]. Three separate real-time monitoring events occurred within a 1-month period. Numerous fires and a foul odor were reported during the first monitoring event. Levels of hydrogen sulfide detected at ground level ranged from less than 10 ppm (the lower detection limit of the sampling device) up to 140 ppm. Levels found in the breathing zone ranged from less than 10 ppm up to 20 ppm.

Levels of hydrogen sulfide detected during the UF sampling activities as well as sampling at the Ohio and Florida landfills exceeded occupational exposure guidance or regulatory ceiling values. Some values approached or exceeded those known to result in olfactory fatigue. Exposures to these levels could result in permanent neurological effects, worker "knock down" (syncope) and death. OSHA inspected the Escambia County landfill following the early 2007 air sampling. Subsequently, a work stoppage was ordered until employees were properly trained and personal protective equipment was provided to reduce hydrogen sulfide exposure.

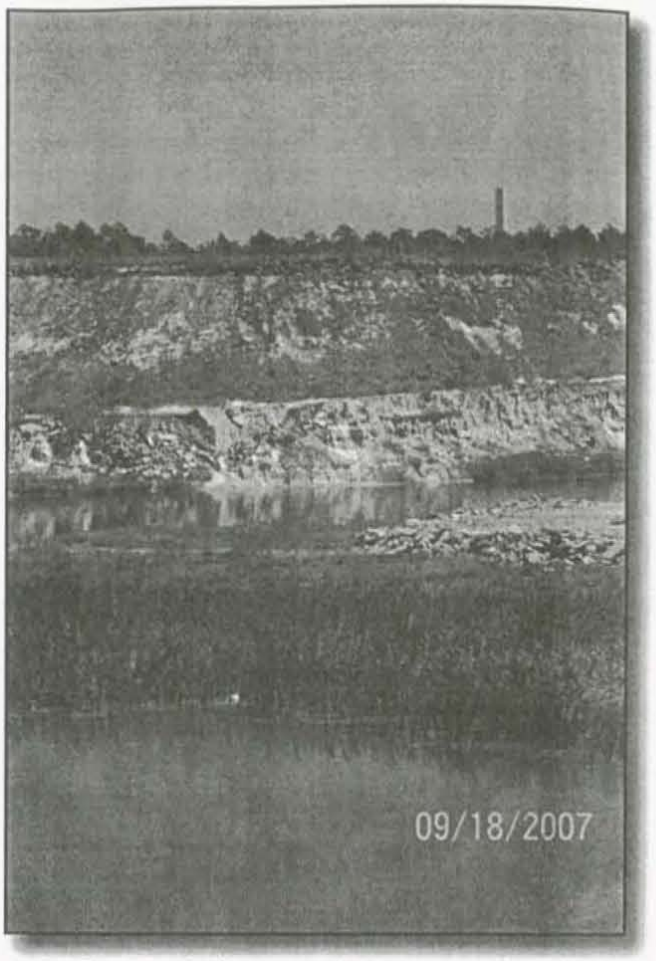
Hydrogen sulfide in residential air and community health and safety risks: The ATSDR conducted residential

air monitoring for hydrogen sulfide around the Trumbull County, Ohio and Escambia County, Florida landfills. In Trumbull, ATSDR became involved by a request from the county school district. In Florida, air monitoring assistance and technical support was requested by the Escambia County Health Department (CHD). Both landfills were surrounded by residential areas, many of which were present prior to the permitting of either landfill.

In Ohio, indoor and outdoor residential air sampling occurred for approximately four months. Hydrogen sulfide levels found inside the homes were greater than 0.09 ppm (upper detection limit of indoor monitors). The maximum level found outdoors was 6.10 ppm. In addition to exposure to hydrogen sulfide, residents were exposed to particulate matter produced in periodic landfill fires. However, public access had not been restricted. Because of these issues, ATSDR concluded that the Ohio landfill posed an "urgent public health hazard" [19]. ATSDR uses the "urgent public health hazard" conclusion for sites requiring rapid intervention where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects [20].

In Florida, ATSDR conducted outdoor residential air sampling for approximately two months. Hydrogen sulfide levels were found as high as 0.224 ppm. Fires occurred at this landfill in the years 2000, 2005, and 2006. Public access was not restricted although health advisories were issued by the county health department. The Florida Department of Health (Florida DOH), with concurrence from ATSDR, concluded that the Escambia County landfill posed a "public health hazard" due to hydrogen sulfide in the air, periodic landfill fires, and unrestricted access [21]. ATSDR uses the "public health hazard" conclusion for sites where long-term exposure (greater than 1 year) to sufficiently high levels of hazardous substances could result in harmful health effects [20].

Currently, the EPA, ATSDR, Florida DOH, Florida DEP, and the Santa Rosa County Health Department (Santa Rosa CHD) are investigating another C&D landfill in Florida. Air sampling for hydrogen sulfide was conducted at one residential location by the Santa Rosa CHD for approximately one month in early 2007. Hydrogen sulfide was detected at levels greater than 0.233 ppm (upper detection limit of the sampling instrument). Fires occurred at this landfill in 2000 and 2005. Florida DOH, with concurrence from ATSDR, concluded that the landfill posed a past public health hazard [22]. At the request of the Florida DEP, the EPA conducted air monitoring for hydrogen sulfide for approximately four months (November, 2007 through February, 2008). Off-site Hydrogen sulfide values periodically approached or exceeded 0.40 ppm.



Community health impact: Community health complaints at all three landfills included eye, nose, and throat irritation, exacerbation of respiratory problems, cough, headaches, fatigue, nausea, and difficulty concentrating. Community members frequently reported that hydrogen sulfide gas entered their homes at night, resulting in their inability to sleep. Although non-specific, these symptoms were consistent with exposure to levels of hydrogen sulfide measured in the air.

Current status of the three landfills: In Ohio, the EPA conducted a time-critical removal action (Superfund) from 2005 through 2006 [17]. Actions included capping and seeding the landfill mounds and construction of storm water management system and a leachate treatment system. More than 13 million gallons of leachate were present at the time treatment began. Upon completion, the maximum value of hydrogen sulfide detected at the fence line was 0.043 ppm compared to 165 ppm in 2005 [17, 23].

The landfill in Escambia County, Florida was closed in 2006 and covered with two feet of soil in 2007. Heavy rains eroded large amounts of this cover and runoff impacted roadways and residential properties. A storm water management system has not been completed. The Florida DEP continues to pursue corrective actions [24] while, residents continue to report odor problems and adverse health symptoms.

The EPA recently completed four months of ambient air sampling for hydrogen sulfide around the landfill in Santa Rosa County, Florida. The Florida DOH is currently evaluating the data to determine the appropriate next steps in protecting the community's health. Residents continue to report odors and adverse health symptoms.

Recommendations to avoid community and occupational health issues at C&D landfills: Based on experiences with C&D landfills, Florida DOH and ATSDR offer the following recommendations to avoid creating problems with environmental contamination and community and worker exposures to these contaminants.

1. Avoid siting landfills in or near residential areas.
2. Respond appropriately to reports of odors and smoke.
3. If hydrogen sulfide, methane, and other flammable gases approach combustion levels, implement

measures to reduce the likelihood of surface and subsurface fires.

4. Take measures to ensure minimal water invasion into landfill contents, including groundwater and rainwater.
5. For additional management practice recommendations, please refer to "Recommended Management Practices to Prevent and Control Hydrogen Sulfide Gas Emissions at C&D Debris Landfills Which Dispose of Pulverized Gypsum Debris in Ohio." [23].

For further information, please contact Samantha Rivers at the Santa Rosa County Health Department: (850) 983-5200, or Samantha_Rivers@doh.state.fl.us

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Landfill Disposal of CCA-Treated Wood with Construction and Demolition (C&D) Debris: Arsenic, Chromium, and Copper Concentrations in Leachate

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Abstract

Although phased out of many residential uses in the United States, the disposal of CCA-treated wood remains a concern because significant quantities have yet to be taken out of service, and it is commonly disposed in landfills. Catastrophic events have also led to the concentrated disposal of CCA-treated wood, often in unlined landfills. The goal of this research was to simulate the complex chemical and biological activity of a construction and demolition (C&D) debris landfill containing a realistic quantity of CCA-treated wood (10% by mass), produce leachate, and then evaluate the arsenic, copper, and chromium concentrations in the leachate as an indication of what may occur in a landfill setting. Copper concentrations were not significantly elevated in the control or experimental simulated landfill setting ($\alpha = 0.05$). However, the concentrations of arsenic and chromium were significantly higher in the experimental simulated landfill leachate compared to the control simulated landfill leachate ($\alpha = 0.05$, $p < 0.001$). This indicates that disposal of CCA-treated wood with C&D debris can impact leachate quality which, in turn could affect leachate management practices or aquifers below unlined landfills.

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Research

Quantities of Arsenic-Treated Wood in Demolition Debris Generated by Hurricane Katrina

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The disaster debris from Hurricane Katrina is one of the largest in terms of volume and economic loss in American history. One of the major components of the demolition debris is wood waste of which a significant proportion is treated with preservatives, including preservatives containing arsenic. As a result of the large scale destruction of treated wood structures such as electrical poles, fences, decks, and homes a considerable amount of treated wood and consequently arsenic will be disposed as disaster debris. In this study an effort was made to estimate the quantity of arsenic disposed through demolition debris generated in the Louisiana and Mississippi area through Hurricane Katrina. Of the 72 million cubic meters of disaster debris generated, roughly 12 million cubic meters were in the form of construction and demolition wood resulting in an estimated 1740 metric tons of arsenic disposed. Management of disaster debris should consider the relatively large quantities of arsenic associated with pressure-treated wood.

Introduction

The total disaster debris produced from Hurricane Katrina in the two hardest hit states, Mississippi and Louisiana, was estimated at 72 million cubic meters (*1*, *2*). Disaster debris is composed primarily of construction and demolition (C&D) debris (50%) and vegetative wood waste (30%) (*3*). C&D debris consists of materials used in construction including concrete, roofing materials, drywall, and wood. Vegetative wood waste consists primarily of shrubs, tree branches, and tree trunks. Because of its nature, vegetative waste does not contain wood preservatives. However, wood used for construction is frequently treated to protect the wood from fungi and termite attack. The most common wood treatment preservative manufactured in the United States through 2003 is chromated copper arsenate (CCA) (*4*). Since 2003, non-arsenical copper-based wood preservatives, such as alkaline copper quat (ACQ) and copper boron azole (CBA), have been primarily used for the residential market. The typical concentrations of arsenic, chromium, and copper in CCA-treated wood used for residential applications are 1800−2800 mg/kg, 1900−3100 mg/kg, and 1200−1800 mg/kg, respectively (*5*). Typical concentrations of copper in ACQ and CBA treated wood are 3500−4500 mg/kg and 2500−3500 mg/kg, respectively (*5*). As a result of these high levels of metals, the C&D portion of disaster debris can be potentially contaminated with metals. Among the metals contained in wood preservatives, arsenic is of primary concern because of its high human toxicity (*6*).

CCA-treated wood has been commonly observed in C&D waste, as documented through studies conducted in Florida (*7*−*9*). Within the wood waste component of C&D, the fraction of CCA-treated wood has been observed to vary from 8 to 22%. Research evaluating technologies for separating treated wood (particularly CCA) from other wood products has been conducted in an effort to remove arsenic contamination due to inadvertent inclusion of CCA-treated wood within mixed C&D debris at recycling facilities. Technologies available for rapid identification and quantification include near-infrared (NIR) spectroscopy, laser-induced breakdown spectroscopy (LIBS), and X-ray fluorescence spectroscopy (XRF) (*8*, *10*, *11*). Recently, handheld XRF units have been used for research to document their utility to further augment sorting and quantification of metals within treated wood (*9*). Such technology, because of portability and provision of rapid results, is ideal for evaluating the potential contamination of disaster debris with wood based preservatives.

The objectives of the present study were to evaluate wood waste generated by hurricane debris for the presence of arsenical-based preservatives (i.e., CCA) and to use these results to estimate the potential extent of arsenic associated with disaster debris. Handheld XRF units were used for this evaluation. Results from the study are useful for establishing policy concerning the management of wood waste after major disasters.

Methods and Materials

Site Selection for Study. Measurements were taken during March 2006 within disaster debris from the New Orleans area. The wood waste portion of the disaster debris was evaluated at seven different sites (Figure 1). Sites included areas with extreme damage characterized by complete collapses of homes and areas where the damage was primarily due to flooding. Among the area with major damage, four sites were selected: two each at Upper Ninth Ward (Sites W1 and W2) and Lower Ninth Ward (Sites W3 and W4). The other three sites (Sites W5 through W7) were located in the inner area of the city where damage was mostly due to flooding.

Measurement of Chemical Treatment within Wood Waste. A total of 225 dimensional lumbers were evaluated using an XRF-analyzer (Innov-X model α-2000S) with at least 24 dimensional lumbers evaluated at each site. The number of lumbers included in the study from a particular site was based upon the apparent volume of wood pile at that particular location, with larger piles resulting in a greater number of analyses. The selection of dimensional lumber for analysis was conducted in a uniform manner with wood pieces tested from different parts of the wood waste pile. Conversion of the XRF readings to As concentrations was based upon a calibration curve between the XRF results and As measurements using traditional atomic absorption analysis for the particular instrument used in this study (*12*; see Supporting Information for more details.)

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Ohio EPA finds toxic chemicals in C&D landfills.

Print

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The average leachate values for nine Ohio construction and demolition landfills exceed the primary drinking water standards for arsenic and lead and exceed the secondary drinking water standards for sulfate, iron and manganese, according to tests done by the Ohio Environmental Protection Agency.

According to the EPA'S findings, the values for cadmium exceed the primary drinking water standard. In addition, the leachate exceeds secondary drinking water standards for aluminum, chloride and total dissolved solids.

According to the report, high levels of contaminants may be leaching out of those landfills. The state's Construction and Demolition Debris Study Council, which is made up of lawmakers, Ohio EPA officials and industry representatives, has received the report. Among the group's responses to the report is a possible need to increase the number of tested compounds from 19 to 64 and a general tightening of the controls on C&D landfills, including increasing the setback limits to 1,000 feet from occupied dwellings.

Several environmental groups in the state have used the report to increase pressure for the tighter regulation of C&D landfills. According the Ohio Environmental Council, "This data seriously undermines the industry's claim that there is no scientific evidence to support stronger controls on construction and demolition waste."

R Lives Count Too, a new advocacy group, has filed proposed ballot language with the Ohio attorney general to have C&D landfills be treated the same as solid waste landfills that take municipal garbage. To get the issue on the November 2006 ballot, the group will need to collect 322,899 signatures, according to local news reports.

"These landfills do pose a threat," says Warren Township resident Debbie Roth, who is a leader of the campaign to put the issue on the ballot.

AN ASSESSMENT OF THE POTENTIAL ENVIRONMENTAL EFFECTS OF THE CROSS ROAD TRAIL RUBBLE LANDFILL

Prince Georges County Special Exception Application No. 4029

Prepared By

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October 8, 1991

Contaminants

In 1988, Community & Environmental Defense Associates (CEDA) conducted a study of five existing rubble landfills. All five landfills were located within Maryland and accepted waste from the general public. We reviewed Maryland Department of the Environment files on all five rubble landfills. This review revealed that:

1. Volatile organic compounds (VOC) had been detected in the monitoring wells at all five rubble landfills. The list of VOCs includes 21 different substances, some of which are suspected cancer-causing agents. None of the 21 VOCs are naturally occurring and, therefore, should not be present in a monitoring well unless introduced through human activity.

2. The presence of some of the VOCs could be attributed to "acceptable" causes. For instance, several of the VOCs may come from the PVC pipe and pipe joint cement used in monitoring well construction.

3. Eight of the VOCs are listed as normal constituents of waste generated by the construction industry. Therefore, some of the contamination found in the monitoring wells may be due to waste legally placed in the rubble landfills.

4. At one of the five rubble landfills, the Brandywine/Cross Trail Road site, located in Prince Georges County, the VOCs resulted from the dumping of unpermitted wastes at the rubble landfill.

5. The extent of contamination at Brandywine/Cross Trail Road was so great that the Maryland Department of the Environment ordered the installation of a leachate collection system. Through this system contaminated groundwater is

pumped into tank trucks and hauled to a wastewater treatment plant for disposal.

6. Wells serving one residence may have been contaminated by VOCs leaking from the Brandywine/Cross Trail Road site.

7. A designated hazardous substance was illegally accepted at the Cunningham rubble landfill, located in Anne Arundel County. The Maryland Department of the Environment issued a Site Complaint & Order requiring the landfill operator to clean-up and remove the hazardous waste to a secure hazardous waste disposal facility.

In summary, the chances are five out of five that VOCs will appear in groundwater monitoring wells if the proposed Cross Road Trail Rubble Landfill goes into operation. The chances are two out of five that unpermitted hazardous wastes will be placed within the rubble fill.

On September 13, 1991 we conducted a second review of Maryland Department of the Environment monitoring records for all of the rubble landfills active in the state. We requested monitoring data for the period of 1988 to the present for the following rubble landfills: Bonifant, Brandywine/Cross Trail, Days Cove, Oak Avenue, Ritchie Land Reclamation, Spencer, and Waste Management of Cambridge. We were provided access to monitoring data for five of these seven rubble landfills: Bonifant, Brandywine/Cross Trail, Days Cove, Ritchie Land Reclamation, and Spencer. Table 4, presents the results of our review of these monitoring records.

As illustrated in Table 4, carcinogenic compounds were detected in monitoring wells or leachate associated with two of the five rubble landfills. A violation of Maryland drinking water standards (COMAR 26.04.01.06) occurred at three of the five rubble landfills. Standards for the protection of aquatic life (COMAR 26.08.02.03) were exceeded at all five rubble landfills.

Based upon this most recent review of monitoring records, one should assume that the odds are two out of five that carcinogens will be released from the proposed rubble landfill, three out of five that Maryland drinking water standards will be exceeded, and five out of five that contaminants will exceed the level deemed safe for the protection of aquatic life.

Generally as the texture of a soil shifts from clay to silt to sand, the pollutant removal effectiveness of the soil diminishes (EPA 1981). This trend results from the high pollutant adsorption rate associated with clay particles. The pollutant removal capacities of soils is illustrated in Table 5.

Table 5: Cation-Exchange Capacity By Soil Texture
(Source: Buckman and Brady, 1969)

Soil Texture	Cation Exchange Capacity (Milliequivalent/100 Grams)
Sand	2.0 - 3.5
Sandy loam	2.3 - 17.1
Loam	7.5 - 15.9
Silt loam	9.4 - 26.3
Clay and clay loam	4.0 - 57.5

As shown in Table 3, on page 5, two of the five soils on the proposed rubble landfill site are silt loam, and the others are a loamy sand, gravelly loam, and a gravelly sandy loam. According to the applicant's site plan and the *Soil Survey: Prince Georges County, Maryland*, only a third to half of the proposed rubble fill will be placed upon the silt loam soils. The majority of the rubble fill will be created on soils with a low cation exchange capacity - the loamy sand and gravelly soils. The loamy sand and gravelly soils also have a high permeability rate, which will allow leachate flowing from the landfill to rapidly pass through the soil column, thus reducing the opportunity for pollutant attenuation. These soil conditions make the 235 acre tract a uniquely unsuitable site for a rubble landfill.

Given the high erosion rates and the poor pollutant removal capacity of the soils, the site proposed for the Cross Road Trail Rubble Landfill should not be converted to such an intensive use. Instead, the County should encourage the property owner to retain the tract in low-intensity uses, such as well-managed farm land.

TABLE 4: Metals and Volatile Organic Compunds Detected in Leachate or Monitoring Wells at Rubble Landfills in Maryland
All concentrations reported in micrograms per liter.

	Maximum Concentration Detected					Water Quality Criteria			
	Days Cove	Brandywine	Bonifant	Ritchie	Spencer	Aquatic Life Freshwater[1]	Drinking Water[2]	MCL[3]	Human Health Effects
Benzene		1				5.3		5	cancer
Carbon tetrachloride		91				35,200		5	probable cancer
Chloroethane		2							
Chloroform		2	1			1,240			cancer
Chromium	320		260			11	50	50	liver/kidney, skin & digestive system
Copper	170		210	60		12			stomach & intestinal distress
Dichlorodifluoromethane		10							
1,1-dichloroethane			1			20,000		5	possible cancer
Ethylbenzene		15				430		700	kidney, liver, nervous system
2-heptanol			1						
Hexachlorodifluoromethane		2							
Mercury				4		0.012	2	2	kidney, nervous system
Methylene chloride	3	49	1						
Methyl-tert-butyl-ether	9	1							
Tetrachloroethane			4			9,320		5	probable cancer
Total organic halide				220	270				
Toluene	3	40	2			17,500		1,000	kidney, nervous system, lung
4-1-PR-Toluene		2							
Trans-1,2-dichloroethane		66	2						
Trichloroethane		110	3						
1,1-trichloroethane			19					200	nervous system problems
Vinyl chloride		40						2	cancer risk
Zinc		650	520	1,430	140	110			
Carcinogen Detected		X	X						
Water Quality Standard Exceeded:									
Aquatic Life	X	X	X	X	X				
Drinking Water	X		X	X					
MCL	X	X	X						

[1] Maryland Department of the Environment Toxic Substances Criteria for Ambient Surface Waters COMAR 26.08.01.03
[2] Maryland Department of the Environment Maximum Contaminant Level for Inorganic Chemical in Drinking Water COMAR 26.04.01.06
[3] National Primary Drinking Water Standards - Maximum Contaminant Level

NEWS

Nanakuli residents are fed up over proposed landfill expansion

The PVT Integrated Solid Waste Management Facility in Nanakuli

By Chelsea Davis | July 16, 2019 at 11:46 PM HST - Updated July 16 at 11:50 PM

HONOLULU, Hawaii (HawaiiNewsNow) - Officials with the PVT Integrated Solid Waste Management Facility in Nanakuli say it needs to expand its landfill because its current location is close to filling up.

PVT is Oahu's only landfill for construction and demolition debris and 80-percent of it is recycled or reused.

At a neighborhood board meeting Tuesday night, Nanakuli residents said they are tired of being the island's dumping ground.

Nanakuli resident DeMont Conner suggested East Honolulu near Koko Head instead.

"We gatta have the biggest homeless population, we gatta have the landfills. Everything society wants to throw away, they send down to the West Side and we're done with that. We're not throw away people and we're not a place where everybody can just put their trash," said Conner.

Ed Werner grew up on Mohihi Street and still has family and friends who live right next to the facility.

He's concerned about their health and says he would like to see a regional park at the proposed location instead.

"We would love to have the park in Nanakuli, that would be a blessing to us," Werner said. "We get five youth baseball teams practicing at one park, a baseball field converted into a football field. Come on."

PVT officials want to expand their landfill to the other side of Lualualei Naval Road and hopefully start using it in the next four years.

"We'll double our recycling. We'll add two recycling lines in. So, we're going to really increase a lot of the things that we're doing on the recycling side," said Steve Joseph PVT Vice President of Operations.

PVT officials say the new landfill will comply with all permits and approvals.

"We have a number of reports that are already out in the EIS including all the backups, including one that the department of health did years ago on it to show that actually, in real fact. You're better off living next to us than you are living in Kapolei. There's less dust. There's less dust than in downtown Honolulu," Joseph said.

Members of the Nanakuli and Maili Neighborhood Board were given copies of the project's Draft Environmental Impact Statement Tuesday night.

The draft EIS will be officially published next week and then opened for a 45-day comment period.

Rensselaer Rally Targets Waste Dumping In The City

By DAVE LUCAS (/PEOPLE/DAVE-LUCAS) • JUN 8, 2019

(//www.wamc.org/sites/wamc/files/styles/x_large/public/201906/IMG_1528_0.jpg)

Former EPA Administrator Judith Enck and protestors in Rensselaer.

WAMC PHOTO BY DAVE LUCAS

Listen
5:25

Environmental activists joined concerned citizens in the city of the Rensselaer this weekend to protest the dumping of waste in the city.

"The city of Rensselaer is facing two very serious environmental threats. And every level of government has failed the people. And that is why you being here today is so important," said former EPA Regional Administrator Judith Enck, a regular WAMC Roundtable panelist, who was among the speakers on the banks of the Hudson Saturday.

The rally targeted the existing Dunn landfill, the largest construction and demolition debris landfill in New York state, which is near a school and a residential area, and an initiative known as the BioHiTech project. The 72,000-square foot facility off Riverside Avenue at the old BASF site would turn municipal waste into fuel.

"In the region there's been a slew of environmental victories when people just like you came together. There are people who came out today from Coeymans. They beat back a terrible proposal to burn solid waste at the cement kiln, and then passed a local law, a local clean air law, that will protect air quality in the whole region. They passed it on and showed up in Catskill where Wheelabrator incinerator company wanted to site a toxic ash landfill a half mile from the Hudson River. Thankfully, because of citizen activism, Wheelabrator went away in a matter of three months. Those citizens are here today and standing in solidarity for a clean environment and protecting public health. I wanna be very clear about what I am advocating. I am advocating the immediate closure of the Dunn landfill," said Enck.

(https://mediad.publicbroadcasting.net/p/wamc/files/styles/x_large/public/20190801trucks.jpg)

Big rigs en route to the Dunn Landfill haul waste along city streets in Rensselaer, NY

CREDIT STOP TRUCKS ASSAULTING RENSSELAER

Lou Sebesta lives on Partition Street, which leads to the landfill. He says trucks line up every weekday morning at 6:30. "They roar past schoolchildren waiting for the bus. They shake the windows, foundations, they're spewing diesel. None of the noise was studied by the DEC when it approved it. I think it's completely ridiculous for them to have said that they anticipated no significant impacts to the neighborhood, the people living in Rensselaer, and they didn't even think about the school, between I-90 and the dump, and they knew that. They knew that the school was there."

Again, Enck: "The Dunn Landfill is owned by a large Texas waste company called Waste Connections. They are paying the City of Rensselaer $800,000 a year to accept this environmental hazard. And let's face it. In a more affluent community, these environmental problems would never exist. It never would have been sited in a more affluent community and it would have been better regulated."

Waste Connections did not respond to a request for comment.

Enck and the activists also called for an environmental impact study to be conducted on the proposed BioHiTech facility.

David Carpenter is director of the University at Albany's Institute for Health and the Environment and has pushed for air testing: "We need to have that Environmental Impact Statement around this site. We need to have the landfill closed because it's very clear because many people, especially the schoolchildren, are impacted by the dust that comes off the landfill."

DEC spokesperson Erica Ringewald says the agency issued permits for the Dunn Landfill based on science and data and will hold the facility accountable if any violations are found. "DEC will continue our strict oversight and scrutiny of the Dunn Landfill site, including our air and groundwater monitoring. We'll also continue to review this facility's compliance with all permit conditions, rules and regulations, to protect this community and the environment."

Rensselaer Mayor Richard Mooney confirms the DEC is working with the city, aggressively monitoring the landfill. The Democrat adds the BioHiTech facility was approved before he became mayor. "Some residents that live down by that facility have reached out to my office with concerns, so we're just asking, I'm just asking that the planning commission just take a step back, keep reviewing it, I also reached out to DEC and requested they do a thorough review of this project, just to make sure we're all safe and sound and on the same page."

At the gathering, Rensselaer County Legislature Chairman Mike Stammel, a Republican running for mayor against Mooney , announced he is proposing a law that would impose a one-year moratorium on any new solid waste permits within a mile of the Hudson River anywhere in the county, effectively halting the BioHiTech project. "We don't wanna be known especially here in the city of Rensselaer as a dump city because there's a dump at one end of the city and a dump they wanna put down the other end of the city."

TAGS: DUNN DUMP (/TERM/DUNN-DUMP) DUNN LANDFILL (/TERM/DUNN-LANDFILL)

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MAY 16, 2019

Old Bend landfill still generates smoldering rumors

A section of a former landfill on which OSU-Cascades plans to build parking lots or athletic fields can be seen from Mt. Washington Drive on Thursday, March 9, 2017, in Bend. (Joe Kline/Bulletin photo)

Rumors of inexhaustible fires burning for decades under the old county landfill are as good as any around Bend.

But those rumors simply aren't true, according to Timm Schimke, director of the Deschutes County Department of Solid Waste.

While there are no flames under the former demolition landfill, Schimke said, smoldering sinkholes have formed over the years when decomposing sawdust quickly grew hotter than other materials in the landfill and collapsed.

"In the end it was determined that we didn't really have a fire down there," Schimke said in February.

But the hot spots of burning chemicals, gases and garbage — hot spots the size of a kitchen table — are dangerous, and still exist.

“We thought over time that activity would subside and go away,” Schimke said. “That hasn’t happened.”

The landfill, which OSU-Cascades is considering purchasing to expand its Bend campus, began accepting waste from Bend’s sawmills in 1972. It was closed in 1997, but not before a tragic accident.

“Two young men saw a crack in the ground with steam venting out and they went to investigate,” Schimke said. “One young man was severely injured.”

In 1991, Lyle Wayne Zimmerman, 16, of Bend, fell into a sinkhole at the landfill and was seriously burned.

According to an account in The Bulletin, Zimmerman fell into a 5- to 6-foot-deep hole on Christmas Eve 1991 and suffered first, second and third-degree burns over much of his body. He was with another teenager, Larry Draper, when he fell through the hole. Draper said he and Zimmerman were walking home when they noticed a thin trail of smoke coming out of the ground.

“There was a little hole there, and we were looking into it. Then the ground that Lyle was standing on fell in,” Draper told The Bulletin. “He yelled that he was on fire … there was just a lot of smoke. He reached his hand up, but I couldn’t pull him up.”

Draper ran across a nearby parking lot to a shuttle bus, where several people helped him pull Zimmerman from the hole.

Zimmerman, a Bend High School sophomore, was flown by helicopter ambulance to Portland for skin grafts.

“Lyle doesn’t remember much, but he told me he thought he had fallen into a 15-foot-deep hell hole,” his mother, Mona Laager, told The Bulletin two days after the incident.

At the time, the property was owned by Bend Metro Park and Recreation District and leased by Mt. Bachelor. Some of the hot spots were identified and mapped before Mt. Bachelor leased the property, Kathy DeGree, former vice president for marketing at Mt. Bachelor, said after the incident.

“It’s not a flaming fire. It’s an underground smoldering fire,” DeGree said in The Bulletin account. “You can’t see flames, but smoke comes out of the ground.”

Schimke said the county continues to periodically monitor the hot spots. He knows inexhaustible flames are not underground, since the gases that come to the surface would have burned off if there were flames, he said.

An account in The Bulletin from 2004 describes the activity 50 to 80 feet under the landfill as pyrolysis, the heating of materials in the absence of oxygen. The byproducts of pyrolysis become even hotter when they hit oxygen at the surface, but the chemicals are not considered dangerous to the health of the community.

“The activity at the Demolition Landfill is not new, and it does not pose any health risks because it does not send high doses of methane into the air,” according to the article.

The biochemical process is like a compost pile on steroids, said Stacy Frost, senior engineer at Maul Foster & Alongi, an environmental engineering firm hired by OSU-Cascades to study the old landfill site.

Although the college hasn’t acquired the old landfill yet, it has a plan to clean or remove the waste. By removing the waste, the pyrolysis would end, according to Frost.

— Reporter: 541-617-7820, kspurr@bendbulletin.com

CantonRep.com
CONNECTING STARK COUNTY

Temperatures rising at closed Exit C&D Landfill

By Kelli Young
CantonRep.com staff writer
Posted May 13, 2009 @ 10:20 PM

Stark County health officials say the dormant Exit C&D Landfill in Osnaburg Township is cooking like an oven, with temperatures reaching levels that would make a steak well done.

Kirk Norris, director of environmental health for the Stark County Health Department, told the county Board of Health Wednesday that the “heating event” does not pose a health risk to neighbors of the landfill at 7099 Fairhill St. SE, but the department is concerned enough that it has consulted the federal and state Environmental Protection Agencies for guidance.

“We’re not calling it a fire,” said Norris, who noted that Exit C&D had a fire in 2003. “There’s no flames, no CO (carbon monoxide).”

He said the county, which has monitored Exit C&D since it closed in 2002, has detected temperatures of up to 160 degrees inside the landfill over the past two weeks.

Normal temperatures range between 120 and 130 degrees for a site that accepts debris from a construction or demolition site but not garbage.

HIGH TEMPS

Higher temperatures are common in a construction and demolition debris landfill, said Ohio EPA Spokesman Mike Settles, whereas elevated temperatures in a landfill that accepts garbage, such as Countywide Recycling & Disposal Facility, would not be considered typical. Ohio and U.S. EPA officials have been working actively with Countywide to determine the source of its underground fires.Norris said heat is generated when a landfill’s waste begins to decompose. Because the county has been removing liquid — mostly snow and ice that’s filtered through the waste — from the bottom of the Exit C&D landfill and reinserting it at the top, a process called recirculation — the decomposition has accelerated, he said.

“Because we’re throwing so much liquid through there, it’s creating more heat than usual,” Norris said.

Norris said the recirculation is needed to prevent the liquid, known as leachate, from overflowing and contaminating nearby groundwater. Previous studies estimated that three million gallons of liquid exist in the landfill.

RECOMMENDATIONS

U.S. EPA officials have recommended that the county stop recirculating the leachate and add more soil to the top of the landfill.

The county instead could treat the leachate on site or could take it to a wastewater treatment facility, said Kurt Princic, environmental manager of Ohio EPA’s Twinsburg office, who has been involved in the discussions.

“By cutting off leachate circulation and covering it up, we think it can be addressed,” Princic said.

Norris said the county is testing the leachate to see what options could be available to the department. He said to remove three million gallons of water probably would cost more than $300,000 — money that cash-strapped county department doesn’t have.

]

County officials protest permit for proposed landfill

Area residents are concerned about environmental issues at site

By BETH KUHLES CHRONICLE CORRESPONDENT
March 10, 2009, 2:51PM

Montgomery County officials will join more than 800 residents to seek a contested permit hearing against a proposed landfill off Texas 105 near North Walker Road.

"This is going to decrease property values," said Montgomery County Judge Alan B. Sadler. "I have been against this from the beginning and I will continue to be against this. It will be a big nuisance in the neighborhood."

Montgomery Landfill Solutions applied to the Texas Commission on Environmental Quality to open a Type IV landfill near a residential neighborhood off Texas 105 in East County. The 493-acre site could handle brush, construction debris, demolition waste, rubbish, tires and yard waste. The permit was given technical approval by TCEQ, which means it could open unless a contested hearing is granted.

"It's unconscionable that this is going on for five years and the TCEQ wants to put a Band-Aid on it," said Leah Smith of Citizens Against Montgomery Landfills, a group opposing the project.

Residents of the area, as well as Montgomery and Liberty counties, Cut and Shoot, Cleveland and Conroe, have been fighting the project since 2005. The residents and governments are concerned about public safety, water contamination and traffic from the site.

Sadler and Precinct 4 Commissioner Ed Rinehart said they would send letters to TCEQ requesting a contested hearing on the case. Rinehart also offered to sponsor buses to allow resident to attend the Austin hearing.

"It's a shame that the TCEQ never listens to what the citizens have to say," Rinehart said. "I am willing to go back. It's pretty disgusting that you go up there and they make the decision about what is going in our neighborhood".

Smith said there are three landfills clustered in East Montgomery County and that some of the waste at the new facility will come from Harris County. The site will generate 600 trucks a day, and the landfill will reach 200 feet in the air, the height of a 20-story building, Smith said.

Since the landfill will be dug 60 feet underground, it could have an effect on two underground aquifers that serve as the drinking water supply for the county. The site also could lead to flooding in the area, as well as air pollution from the deteriorating debris, Smith said.

Initially, the landfill was going to served via North Walker Road, which is the entrance to the residential neighborhood, but the entrance has been moved to Texas 105.

Requests for a contested permit hearing will be accepted by the TCEQ through March 30. The next step is for the TCEQ Commissioners to consider the permit and the public hearing requests. If a public hearing is granted, the permit will go to the state Office of Administrative Hearing for a proposal for decision. That proposal will be presented to the TCEQ Commissioner for a final decision. The commissioner can accept, reject or modify the proposal, said Terry Clawson, a spokesman for TCEQ.

Resources

PROPOSED LANDFILL

Montgomery Landfill Solutions has applied to the Texas Commission on Environmental Quality to operate a landfill off Texas 105 near N. Walker Road in East County. The permit is technically complete, but more than 800 residents have filed letters with the TCEQ for a contested hearing on the permit. Following is information on the proposal landfill:

Located off N. Walker Road and Texas 105

493 acres

Type IV Landfill, includes brush, construction debris, demolition waste, rubbish, tires and yard waste

600 trucks a day would serve the facility

Entrance relocated to Texas 105

Opposed by Montgomery and Liberty counties, Cut and Shoot and Cleveland; supported by Conroe

Source: Texas Department of Environmental Quality

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State Settles Lawsuit Over New Orleans Debris Landfill

WED MARCH 01, 2006 - SOUTHEAST EDITION
CEG

NEW ORLEANS (AP) Louisiana's environmental agency has settled a lawsuit over a New Orleans landfill where debris has been dumped since Hurricane Katrina, but Mayor Ray Nagin recently ordered suspension of a zoning ordinance to allow a new landfill not far away, and close to a national wildlife area.

The state Department of Environmental Quality and the Louisiana Environmental Action Network settled the suit Wednesday that the environmental group brought in protest of the state's decision to relax requirements after Katrina and allow the Old Gentilly Landfill to reopen for construction and demolition debris.

The department in the settlement agreed to limit, temporarily, daily dumping at the landfill to 19,000 cubic yards of waste and to study how dumping could affect the nearby Intracoastal Waterway levee. Regulators also promised to add water-monitoring wells and to allow the public to weigh in on the reopening.

Louisiana Environmental Action Network attorney Joel Waltzer said he hopes the change will lead to the landfill's closure.

But Dana Stumpf, president of AMID/Metro Partnership LLC, which operates the Old Gentilly site, was unhappy with the settlement. By sharply reducing the amount of debris that can be dumped at Old Gentilly, the city's cleanup will be slowed, she said, because other landfills are too far away.

"We're the logical choice and the most efficient choice," Stumpf said, citing her company's polls of haulers that showed they would take four to five loads per day to Old Gentilly versus 21/2 loads to other locations.

The new landfill, which like Old Gentilly would accept construction and demolition waste, would be operated by Waste Management of Louisiana, holder of the city's contract for residential garbage pickup, according to Nagin's executive order.

Nagin defended his authority to suspend zoning laws, citing an earlier declaration of a state of emergency that gave him wider authority than usual. The order says "the threatened closure of the only construction and demolition landfill site in the city necessitate(s) the immediate opening of an alternative temporary location."

DEQ officials said they were aware of plans to try to create a landfill at the site but that they had received no applications.

Waltzer denounced the idea of opening the second landfill, on a nearby property that abuts the Bayou Sauvage National Wildlife Reserve and was previously rejected as a landfill site. Waltzer said the site is near a section of town populated by Vietnamese-Americans who have been working to restore their flood-damaged properties.

"It's a very poor idea," Waltzer said. "And again, you're right next to a levee, and you're next to a wildlife preserve. They're inviting another lawsuit if they even think about it."

Page 6A, Monday, November 22, 1999

Queen Anne's

THE STAR DEMOCRAT

Public testimony ends at rubblefill hearing

• Decision by board probably not until January

By KONRAD SUROWIEC
Staff Writer

CENTREVILLE — A decision on the proposed rubblefill near Millington will probably not be made until at least January.

Public testimony at a hearing before the Queen Anne's County Board of Appeals ended Thursday night. Board chairman Marion Leaverton said it would likely be January before the board would reopen the hearing to make a decision. In the meantime, the board will meet with its lawyer in closed session to review legal papers to be submitted by each side in the dispute.

Days Cove Reclamation Company is seeking a conditional use permit from the appeals board to build and operate a rubble landfill on a 58-acre property at Glanding and Peters Corner roads. Board solicitor Thomas Ross said Dec. 6 is the deadline for Days Cove to submit its memorandum and Dec. 16 is the deadline for a group of opponents to file its memorandum.

Hearings on the Days Cove case were held Sept. 23, Sept. 30 and last Thursday. About 100 people attended the last session, including about 10 county residents who spoke out vigorously against the proposed rubblefill. Several people testified for Days Cove, including the design engineer and a traffic consultant for the project.

"We have a nice quiet area that on a busy day gets four large trucks, maybe," said Kenneth Todd Bittner of Hackett Corner Road. The landfill would result in 12½ times as much heavy truck traffic, he said.

Days Cove representatives said an average of 50 trucks a day would haul debris from construction, demolition and land clearing projects to the landfill. Tanker trucks — from as few as six a month to as many as 70 a month — would haul leachate from the landfill. The trucks would have to follow a prescribed route which would include U.S. Route 301, state routes 544 and 313, and Hackett Corner and Glanding roads.

Residents have objected to the rubblefill for several reasons, including an increased number of heavy trucks on area roads; the potential for landfill contaminants to pollute area drinking wells, and the nearby Unicorn Branch and Unicorn Lake; and the potential for lowered property values. Residents said they would be forced to deal with a dump for the second time.

> "The stuff coming out of this pit is hazardous waste. ...It belongs in an industrial setting, not an agricultural community."
>
> Albert Deemer
> resident

The Days Cove landfill would be built across the street from the county's closed down Glanding Road landfill. The county operates a waste transfer station next to the old landfill.

The proposed rubblefill is "too high a price" to pay for the people of Kent and Queen Anne's counties, said Loretta Walls, president of the Millington Quality of Life Preservation Coalition.

About 30 percent of the homes in the Millington, Sudlersville, Pondtown and Crumpton areas use water from an aquifer under the site of the proposed landfill, said Albert Deemer of Red Lion Branch Road.

"The stuff coming out of this pit is hazardous waste. ... It belongs in an industrial setting, not an agricultural community," said Deemer.

Increased truck traffic will increase the chances of accidents and fuel spills, said Joseph Glenn Pyle, second assistant chief for the Millington Volunteer Fire Company.

He said the volunteer fire companies serving the vicinity of the landfill — Millington, Crumpton and Sudlersville — are small companies which lack the training and equipment to handle hazardous waste spills.

Austin Appenzeller, a farmer who has lived on Highman Mill Road for 42 years, submitted photos of homes and farms located within a half mile of the proposed landfill.

He said the road-widening projects planned in conjunction with the landfill would destroy one of the few natural areas left in the county.

Centreville area resident Paul Gunther said the materials headed for the landfill should be recycled, not dumped in the ground.

Concrete and other rubble materials could be used to prevent erosion on the county's 168 miles of shoreline, said Gunther, representing the University of Maryland's Cooperative Extension branch in Centreville and the Queen Anne's County Farm Bureau.

"There's really nothing going into this landfill that shouldn't be recycled," said Gunther, who asked board of appeals members "to dig in your heels" and reject the application.

Kenneth R. Binnix, executive vice president of Days Cove, said steel, aluminum, scrap tires, wood and yard waste would be separated from the debris for recycling.

Bill Tafuto, design engineer for the landfill, criticized a report submitted by Richard Klein, an environmental consultant who testified against the landfill at the Sept. 30 hearing.

"His analysis and conclusions are invalid," said Tafuto.

Volume 9 Number 4 (October 1998)

Ma'alaea Landfill Fire Sparks State Effort to Develop Guidelines

Almost every Hawaiian island has at least one landfill now on fire, and every Hawai'i landfill except Hilo's has been on fire within the last six years, according to the state Department of Health. However, a relatively small fire in a private landfill on Maui has ignited efforts to create what may be the first guidelines in the country for dealing with underground fires.

Currently, no county has been required to extinguish fires at municipal landfills. However, the DOH is forming a working group to study their possible health effects. Of special concern are the longer-term fires, such as the one burning for some five years now in the now closed Kona landfill.

The Spark

On January 26, 1998, an employee at Richard DeCoite's construction and demolition (C&D) landfill in Ma'alaea, Maui, noticed an odd odor, which led to the discovery of a fire 15 to 20 feet underground. Attempts were made to smother it with injections of more than 1,000 pounds of liquid carbon dioxide. The fire was eventually deemed to be extinguished in a matter of weeks, although it continued to smolder for four months.

The source of the blare was probably a palm tree from an area where brush had been cleared.

Municipal landfill fires are mostly caused by methane gas from decomposing organic matter. C&D landfills, on the other hand, contain items like rebar, concrete, lumber and cleared brush. Decomposition is not the problem; cleared brush is.

According to Jeff Darcy, environmental engineer in the Air Enforcement Office of the Environmental Protection Agency, Region Ix, Hawai'i has less rigorous air quality standards because of its tradewinds, low population density and isolation. Thus, when Maui developers or contractors clear brush, they are allowed to burn it before taking it to a landfill; this decreases the volume of their haul, and thus the amount they will be charged.

Any material that has been burned should, of course, be cooled before it is dumped. Ma'alaea's landfill has two inspection sites to check for "hot loads." One site is at the scales, where an employee looks at the load to check its origins and talks to the hauler. After the load is dumped, it is inspected again for heat or hazardous materials like paint, asbestos, or chemicals.

During the Ma'alaea fire, temperature probes found the main hot spot to be a charred palm tree that had become a briquette. (The tree had the most ash surrounding it, signifying the most intense heat).

Because palms are spongy inside, they retain heat for a long time. Both the person who dumped it as well as the landfill's employees probably saw a tree that was cooled on the outside. Once in the dump, however, the heat inside the tree simmered and finally erupted in a blaze.

Living Downwind

The odor produced by the fire and subsequent efforts to put it out reportedly caused headaches, nausea, and swollen eyes for many residents living about a mile downwind of the landfill.

Tanya Every, a resident of Ma'alaea for 15 years, said she sought emergency care for what was diagnosed as a sinus infection. In addition to medical expenses, she says she spent about $1,000 on an air conditioner so she could keep the odor from entering her home.

Ma'alaea resident Alice Perry says the smell became so pervasive that every night in early February, she would be awakened with a choking sensation. She said the odor lasted into May, but grew more episodic as the fire began to be controlled.

By March 20, Maui County found the odors had been sufficiently reduced, so it allowed the dump to continue operating alter giving the operator one week to control the odor. Charles Jencks, director of Maui County's Public Works and Waste Management Department, says the county monitored the site daily until the beginning of the summer, when the smell stopped. When asked to describe the odor, Jencks compared it to a household barbecue that had been doused with water.

Permit Problems

But even as the fire was being brought under control, DeCoite's problems did not end. In the scrutiny of public anger, DeCoite was found to have been operating his landfill without a valid special land-use permit since the previous one expired on September 30, 1997. The county gave him until May 12 to get the new permit from the Maui Planning Commission.

On the day of the deadline, the commission denied DeCoite's application for a new permit. Instead, the commission had approved an "intervention" in the case, allowing both the Ma'alaea Community Association and the landfill operator to present evidence and arguments in a formal hearing. (The intervention is now set to begin in November.)

Afterward, the county Planning Department ordered the landfill closed.

Ongoing Concerns

Most of the flammable substances in the Ma'alaea landfill - Maui County's only construction-material landfill -are lumber products, which are often treated with such preservatives as chromated copper arsenate (CCA).

Burning pressure-treated wood is illegal nationwide because of the carcinogenic and lethal dangers from inhaling, ingesting, or touching the ash. The heavy metals in CCA, when incinerated, become very concentrated in the remaining ash.

In a June 22 letter to John Harder, head of the Department of Health's Solid Waste branch, Jack Mueller, chairman of the Ma'alaea Community Association, wrote, "Our community has been bartered by the noxious odors from the pit. When we filed our request for intervention with Maui County, we filed with it some fifty letters, e-mail, etc. from residents who had suffered health problems, inconvenience, and financial losses, and in addition, a petition with 1000+- signatures asking for the closing of the pit."

He went on to say that, "in almost every one of these letters, the writers stated that one of their symptoms was persistent headaches. In reading the affects of airborne arsenic poisoning this [headache] is one of the first symptoms.

However, CCA ash is very heavy, rarely rising into the air, particularly when it is trapped in an earthen oven.

This may explain why, when engineers from DOH took air samples from the landfill and from the air around the Ma'alaea condominiums, they did not find any detectable arsenic, chromium, or other health risks.

Testing

Darcy, the air quality engineer with the EPA, became involved on March 9, after he was called by a Ma'alaea resident. Darcy in turn called Harder. Darcy says his office has no regulations regarding landfill fires, so he called Hawai'i to see whose jurisdiction it would come under: that of Maui County, or the DOM, which is in charge of regulating landfills.

"This may have been the impetus for the state to do the air sampling," Darcy said. "I don't know. My role was to get the people talking and let them resolve it."

On March 19 and 20, DOH's Hazard Evaluation and Emergency Response (HEER) toxicologist Jon Pierre Michaud and DOH Solid and Hazardous Waste engineer Gary Sin took air samples during the day from the rim of the landfill as well as in the pit itself During the night, when residents said the odor was the worst, they sampled the air from a Ma'alaea condo. The samples were then analyzed for the presence of more than 100 compounds.

Residents thought the delay between their original complaints in February and testing was far too long, but Harder says they ran the tests as soon as they obtained permits and funds to rent the testing equipment from the mainland. He estimates they ran the test two weeks aflter the peak of the fire (officially extinguished in February, as noted by lower core temperatures), while it was still smoldering at about 120 degrees Fahrenheit.

"We responded to the community's concerns", Michaud says, "but we have to base our decisions on what we actually find when we go out and measure.

They did not find much.

The results from the pit (at the corner of Honoapi'lani Highway and North Kihei Road) showed most of the air particulates were from dust, not smoke. Concentrations of all the substances tested for, including sulfurs, volatile organic carbons, arsenic and carbon monoxide, were well below health guidelines.

Samples taken from the condominium area were much the same. Siu and Michaud's report notes that the monitors at the condos were placed on a back balcony of the unit closest to the landfill and on the roof of a condo that was second closest to the pit, but a story higher and above most ground-level contaminants.

"We would never deny that people are having symptoms, but we would try to figure out what is causing them," Michaud said. He and Siu found other nearby sources of particulates, including the cane fields, the MECO Ma'alaea power station and the Kealia pond and wetlands (which, in dry weather, are a source of dust).

In early September, Siu and Michaud returned to Maui to conduct further tests at Ma'alaea and at other sites where landfill fires are suspected. "So far as we could tell," Michaud told Environment Hawaii, "we do not perceive any hazards. The situation has abated, but we would like to analyze the data [consultant] Steve Joseph has collected to make sure the fire is indeed out."

A Broader view

Harder says the Ma'alaea fire and resulting outcry has caused his agency "to look a little bit differently at landfills." He says several database searches were run and meetings were held with the EPA and counterparts in other states, but little information on controlling the fires was available when the Ma'alaea landfill fire broke out.

Darcy says he, too, tried to gather information on regulations and methods for controlling landfill fires for health risks, but could find next to nothing.

Steve Joseph, a landfill consultant, is hoping to help the state devise some general strategies through the working group that the DOH is setting up. He said the possibility is high for doing something innovative and comprehensive about landfill fires.

Joseph, employed by Masa Fujioka & Associates of O'ahu and retained through them by the operator of the Ma'alaea landfill, says he thinks little has been researched or written about landfill fires because no operator wants to admit to having a fire on site. Also, he says, since they are so common, and so expensive to put out, many operators try to ignore them, hoping they'll go out on their own.

The DOH's Michaud is also involved in the working group, as is Sin of the DOH Office of Solid Waste Management; in September, Michaud left the DOH to begin work at the University of Hawai'i, but he is hoping to continue his involvement. He would like to look at present landfill fires; test what, if anything, is emitted; learn how to control contaminants; discover what causes ignitions; and develop efficient methods to extinguish the fires.

"We'd like to get a better picture and get onto it earlier," he says. "But it's not like there are standard cookbook operations. You have to go and figure it out case by case."

Harder said the Ma'alaea site continues to be monitored with temperature probes and liquid carbon dioxide available to spray immediately on any hot spots. However, he says, as for his office, the fire incident is closed. "This is one of the better fire responses we've seen," he adds.

Michaud agrees. "The operator has made a tremendous effort to do everything right," he says.

THE KANSAS CITY STAR.

THURSDAY, May 14, 1992

MID-AMERICA EDITION 50c

$2 million awarded to neighbors of landfill

Deffenbaugh site damaged lives, families say.

By MATT CAMPBELL
Staff Writer

A jury Wednesday awarded more than $2 million to two families who say their property and lives have been damaged by the neighboring Deffenbaugh landfill in Independence.

The award is one-third of the $6 million net worth of Deffenbaugh Industries Inc., which owns the Woods Chapel Landfill on R.D. Mize Road just north of Interstate 70.

Deffenbaugh Industries is a conglomerate of waste companies based in Shawnee with interests in Nebraska, Ohio, Texas, Louisiana, Minnesota and Oklahoma.

The 2½-week trial in Jackson County Circuit Court is the latest turn in several disputes and lawsuits between Deffenbaugh and landfill opponents that goes back to 1984, the year Deffenbaugh bought the landfill.

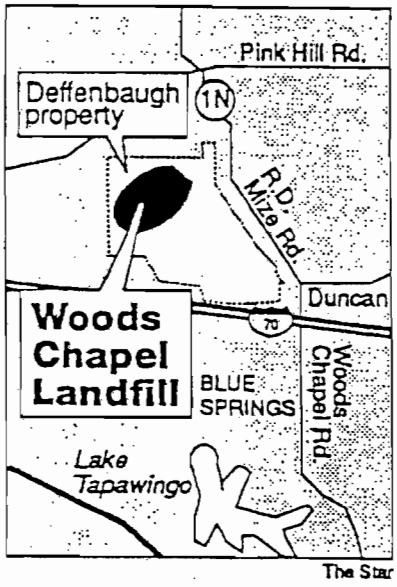
"These people have been listening to Deffenbaugh say for years that nothing is wrong," lawyer John Turner said of his clients. "Now they have a jury that listened to the evidence and said that there is something very wrong out there."

The civil lawsuit filed in 1989 by Joe Stevinson and Ross and Carol Miller alleged that odors, trash and the liquid that leaks out of the landfill have impaired their ability to enjoy their property and have hurt its value.

The families have owned about 380 acres adjacent to the dump since before the site was initially used as a landfill in the early 1970s. Their property is zoned predominantly agricultural. Both Stevinson and the Millers live on their properties.

A real estate appraiser testified that the plaintiffs' properties, which bound the landfill on three sides, had suffered in value directly because of the landfill.

Carol Miller said the trial was exhausting but that she was happy to have been vindicated.



Deffenbaugh attorney Richard Rhyne said he was surprised and disappointed at the verdict but was confident it would be overturned on appeal. He said he would point to errors in the trial procedure in his brief to the Missouri Court of Appeals.

"Basically, people don't like landfills," Rhyne said, "and I think there was evidence of that in this verdict."

But Rhyne said he believed the size of the award — in one category larger than the plaintiffs had asked for — indicated the jury was impassioned and not

$2 million awarded to neighbors of Deffenbaugh landfill

In the first part of its two-part verdict, the jury awarded actual damages of $810,416 to the Millers, $493,750 to Stevinson, and $262,750 to an auto and electric school owned by the Stevinson family.

The jury retired again to deliberate punitive damages. They awarded $212,000 each to the Millers and Stevinson and $30,000 to the auto school.

"We did not want to break the company," said jury foreman Doug Smith. "But we did not want to slap them on the wrist and let them feel they could continue to do this to people and the community."

Smith and fellow juror Angie Trompeter both said they were particularly alarmed to learn what the landfill operators did with the contaminated liquid, which is carefully collected in pipes and tanks surrounding the landfill.

A Deffenbaugh employee testified that some of the liquid — called leachate — was poured onto dirt roads on company property to control dust. The company continued to do this after the trial began.

Turner said the leachate was tested and included elevated levels of arsenic and lead.

"That horrified us," Smith said. "Heavy equipment on the roads would kick up the dust and that dust had leachate in it. People are walking around breathing this stuff."

The drainage pattern at the landfill carries runoff to the Little Blue River and then to the Missouri River.

The Millers said they also have found medical wastes from the landfill on their property.

Smith said jury members also believed the Missouri Department of Natural Resources was lax in inspecting landfills and enforcing the law.

A key point that worked against Deffenbaugh, Smith said, was the company's continued operation of the Woods Chapel Landfill after its municipal permit from Independence expired in 1987.

The city refused to extend the permit, and the two sides began a court battle that was settled with an agreement that the landfill would close no later than August of this year.

But Deffenbaugh then sought a new permit and talked of using the landfill for 20 more years. In April, the Independence City Council refused the new permit.

Last week, Deffenbaugh filed another lawsuit against the city. In it, Rhyne argues that Independence zoning laws are invalid and that the city is, in effect, taking Deffenbaugh's property away without compensation.

Community

A SECTION

County tests air quality at home abutting dump on Kenilworth Lane

By Caren Halbfinger
Staff Writer

Beverly Brilliant of 17 Kenilworth Lane, didn't know whether to hope for the best or fear the worst yesterday as a Westchester County Health Department sanitarian tested the air quality at her home.

Since a 33,000-ton pile of non-toxic industrial waste moved in next door two years ago, Brilliant, her family and their neighbors have been suffering a variety of ailments they attribute to the dump.

"My husband is covered with a red rash everywhere," Brilliant said. "I have a lot of headaches, and my daughter Natalie has been complaining of headaches. It's a slow, cumulative not knowing. I'm scared."

Health Department spokeswoman Nancy McPartlin said department officials could not comment yesterday on the test results or what action the department might take.

"We should have the results tomorrow," she said. "We have to review the information to decide what the next step is."

Sanitarian David DiPrinzio told Brilliant that he found levels of organic vapors between 5.5 and 6.5 parts per million, which he said was in the acceptable range. DiPrinzio wouldn't say what the Health Department set as a limit for vapor levels.

The highest concentrations were found upstairs, in Brilliant's daughters' bedrooms.

Organic vapors can include emissions from ordinary non-toxic household products such as paint, plastics and carpeting. But they can also include cancer-causing gases.

"I really can't tell exactly what's here," DiPrinzio told Brilliant.

Levels at Brilliant's home were four times those found across the street last week at 14 Kenilworth Lane. McPartlin said air quality there was satisfactory.

The fill has been leaching a black, sulfurous-smelling liquid for the past two years since it was dumped illegally to regrade land on several properties. Cleanup of the debris has been delayed while the haulers, four property owners and Westchester County argue in court about apportioning the multimillion-dollar cost.

Residents near the site are particularly concerned about the possible presence in their homes of hydrogen sulfide and chlorinated solvents, both of which were found at the dump site. Long-term exposure to low levels of those chemicals can damage the central nervous system, liver and skin.

"All we're asking is that government assure us there is not a risk to our health," said Jonathan Hutson, Westchester coordinator for Citizen Action of New York, a non-profit public-interest group. "The equipment used today is not sensitive enough to give us such an assurance."

Hutson said he was familiar with the equipment used by the Health Department since he has a grant from the state Department of Labor to teach small-business owners about chemical hazards in the work place.

"The county could borrow or rent the equipment they need," he said. "An infrared photospectrometer rents for about $100 a day. That's not too great an expense to assure us our health is not at risk."

Brilliant said she would be the host at 8 p.m. July 10 of a meeting of Pollution Solution, a community group open to any citizens interested in protecting their health, environment and property values. The group was organized last month by Kenilworth Lane neighbors to force an immediate cleanup of the Kenilworth Lane dump and assess the risks it has placed on their health.

United States Environmental Protection Agency
Solid Waste and Emergency Response (OS-305)
EPA/530-SW-90-027
January 1990

EPA

Does Your Business Produce Hazardous Waste?

Many Small Businesses Do

UPDATED EDITION

REPLACES EP TOXICITY

WASTE MINIMIZATION

Waste Minimization Should Be the Key Component of Your Company's Hazardous Waste Management Program

Many small businesses produce hazardous waste.

If yours is one of them, this brochure will help you comply with new hazardous waste laws.

Federal law requires many small businesses to meet requirements for handling hazardous wastes.

In 1976 the Congress of the United States passed a law called the Resource Conservation and Recovery Act (RCRA). Under RCRA, the United States Environmental Protection Agency (EPA) has developed specific requirements for handling hazardous waste in ways that protect human health and the environment. These requirements control hazardous waste from the moment it is generated until its ultimate disposal. Since 1980, EPA has been improving the hazardous waste program to further protect public health and the environment. As a result, the requirements were expanded to include small businesses that handle specified quantities of hazardous waste, and the number of hazardous wastes has been increased.

EPA's definition of hazardous waste was recently expanded to cover many additional toxic compounds, including some commonly used by small businesses.

Under these new regulations, many previously regulated businesses will be required to handle *additional* wastes as hazardous waste, and *many small businesses never before regulated under federal hazardous waste laws* must comply with hazardous waste requirements.

Defining Hazardous Waste

A waste is a solid or liquid material that is no longer used. You either throw waste away or store it until you have enough to warrant disposal. EPA defines waste as hazardous if it has certain properties that could pose dangers to human health and the environment after it is discarded.

EPA considers a waste to be hazardous if it possesses certain characteristics (ignitability, corrosivity, reactivity, or toxicity) or if it is on a list of specific wastes determined by EPA to be hazardous. All "characteristic" and "listed" wastes must be handled according to federal hazardous waste regulations. You must check to see if your waste is on the EPA list. If it is not, you must determine whether it exhibits one of the characteristics. If you are not sure, you can have it tested in a laboratory to determine whether it is hazardous. (See "A New Test for Toxicity" below.) You will generally be able to tell if your waste might be hazardous by reviewing label information (i.e., if it says things like "flammable" or "poison").

RCRA regulations, found in the Code of Federal Regulations (CFR) Title 40, Part 261, present the "listed" hazardous wastes, describe hazardous waste characteristics, and specify test methods for determining whether waste is hazardous.

Do Hazardous Waste Requirements Apply to You?

The following information will help you determine whether your business might be a small quantity generator of hazardous waste. If you think your business is, contact your EPA Regional office or state hazardous waste management agency to see what you need to do to comply with the regulations. The EPA Regional contacts and state contacts are listed in this brochure.

How to Determine Whether Your Business Produces Hazardous Waste

Your business is likely to produce hazardous waste if you:

- Use petroleum products
- Use dyes, paints, printing inks, thinners, solvents, or cleaning fluids
- Use pesticides or other related chemicals
- Use materials that dissolve metals, wood, paper, or clothing (acids and caustics)
- Use flammable materials
- Use materials that burn or itch upon contact with skin
- Use materials that bubble or fume upon contact with water
- Receive delivery of products accompanied by a shipping paper or label indicating that the product is hazardous.

Such businesses might include those that:

- repair and maintain motor vehicles
- do electroplating and other metal manufacturing and fabrication
- operate printing and reproduction equipment
- do drycleaning and laundering
- do photographic processing and printing
- operate laboratories
- do building, road, and other construction
- provide home or industrial pest control
- manufacture or process chemicals
- manufacture or formulate pesticides
- manufacture textiles (including fabric dyeing and finishing)
- make or refinish furniture
- manufacture or process cosmetics
- chemically treat lawns, yards, or gardens
- do wood preserving
- manufacture paper and paper products.

A New Test for Toxicity

One property that determines whether a waste is hazardous is its toxicity. Toxic waste is harmful or fatal when it is swallowed or when it comes into contact with the skin. When toxic waste is disposed of on land, contaminated liquid might drain (leach) from the waste and pollute ground water.

Since 1980, toxicity has been determined using the "Extraction Procedure (EP) leach test," which tests whether a waste is likely to leach certain metals or pesticides into ground water. The EP test, however, only applied to a handful of toxic constituents. Other toxic constituents were not detected by the EP test.

In March of 1990, EPA issued a new "Toxicity Characteristic" rule which changes the test for toxicity. The new test is called the Toxicity Characteristic Leaching Procedure (TCLP). The TCLP is used to test for 25 organic chemicals (see list below) in addition to the metals and pesticides that had been tested for in the EP leach test. Small businesses are required to comply with the Toxicity Characteristic rule beginning March 29, 1991.

The changes in the regulation mean that many wastes that previously were not covered will now be subject to federal hazardous waste regulations. Contact your EPA Regional office to find out if these changes will affect you. Information in the industry-specific inserts included in this brochure can also help you determine how the new requirements apply to waste that your business might generate. Generally, if you use a product that contains one of these chemicals, your waste might well be hazardous.

The Following Constituents Are Now Regulated under the TC Rule:

Old EP Constituents

Arsenic
Barium
Cadmium
Chromium
Lead
Mercury
Selenium
Silver
Endrin
Lindane
Methoxychlor
Toxaphene
2,4-Dichlorophenoxyacetic acid
2,4-Dinitrotoluene
2,4,5-Trichlorophenoxypropionic acid

New Organic Constituents

Benzene
Carbon Tetrachloride
Chlordane
Chlorobenzene
Chloroform
m-Cresol
o-Cresol
p-Cresol
Cresol
1,4-Dichlorobenzene
1,2-Dichloroethane
1,1-Dichloroethylene
2,4-Dinitrotoluene
Heptachlor (and its hydroxide)
Hexachloro-1,3-butadiene
Hexachlorobenzene
Hexachloroethane
Methyl ethyl ketone
Nitrobenzene
Pentachlorophenol
Pyridine
Tetrachloroethylene
Trichloroethylene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
Vinyl chloride

If You're Not Sure, There's Help

If you are uncertain whether your business produces hazardous waste, contact EPA's RCRA/Superfund Hotline at (800) 424-9346, your EPA Regional office, or your state hazardous waste management agency. EPA Regional offices and state hazardous waste management agencies are listed below. These contacts can provide a list of all wastes identified by EPA as hazardous. They can also tell you about testing laboratories that can help you determine if your wastes are hazardous, even if they are not included on EPA's list.

How Much Waste Must a Business Produce To Be Regulated under Federal Hazardous Waste Requirements?

EPA considers you a small quantity generator if your business produces more than 220 and less that 2,200 pounds (more than 100 and less than 1,000 kilograms) of hazardous waste in a calendar month. Small quantity generators are subject to the hazardous waste requirements described in this brochure. You should be aware that your state may have additional or more restrictive requirements. The state requirements that apply to you depend on where your plant or facility is located; this may be different from your corporate mailing address.

If you produce 1,000 kilograms or more of hazardous waste in any calendar month, or more than one kilogram of certain acutely hazardous wastes, you are subject to the more extensive regulations for large quantity generators. (Acutely hazardous waste is waste that is fatal to humans in low doses. See 40 CFR 261.11(a).)

If you never produce more than 100 kilograms (approximately one-half of a 55-gallon drum), and no more than one kilogram of acutely hazardous waste in a calendar month, then you are exempt from most of the federal hazardous waste requirements. However, you must determine whether your waste is hazardous and ensure that hazardous waste is delivered to a facility permitted, licensed, or authorized by EPA or the state to accept hazardous waste. It is important to be aware that some states do not recognize exemptions for this category of hazardous waste generators. Check with your state hazardous waste agency to determine your obligations under state law.

If Your Business Produces Hazardous Waste and Is Regulated Under the Federal Hazardous Waste Requirements, You Must:

- Obtain an EPA identification number for each site at which hazardous waste is generated. To obtain an EPA identification number, contact the EPA Regional office or your state hazardous waste management agency and ask for Form 8700-12.
- Properly handle your waste on your premises, following federal and state requirements. If you store, treat, or dispose of your hazardous waste on site, you might need a permit. Contact the RCRA/Superfund Hotline or your EPA Regional office for permit information.

OR

Periodically ship your waste off your premises for treatment or disposal, following federal and state requirements.

Storing Hazardous Waste at Your Facility

- You may store hazardous waste on site without a permit for up to 180 days (or 270 days if the waste is to be shipped more than 200 miles) as long as you never accumulate more than 6,000 kilograms (13,200 pounds) of hazardous waste on site.
- You must obtain a permit to store waste on site for longer than 180 days (270 days if the waste is to be shipped more than 200 miles). If you have questions, contact your EPA Regional office or your state agency.
- You may accumulate as much as 55 gallons of hazardous waste in a "satellite accumulation area"—an area at or near the point of generation. Once you accumulate more than 55 gallons in the satellite accumulation area, you must move the waste to your hazardous waste storage area within three days and follow the hazardous waste storage requirements described above.

May Waste Be Managed at Your Facility Rather Than Being Shipped Away for Disposal?

Yes, you may manage your hazardous waste at your own plant, but ONLY if you are permitted, licensed, or authorized by EPA or the state to do so. The permit ensures that your facility meets the standards established by RCRA for proper waste management. Certain kinds of recycling and wastewater treatment can be conducted on site without a permit. Contact your Regional EPA office or state agency for information about whether you need a permit and how to obtain it.

How to Ship Hazardous Waste Off Your Premises

Under federal law, you must:

- Use only authorized hazardous waste transporters with EPA identification numbers to transport hazardous waste.
- Send hazardous waste only to facilities permitted, licensed, or authorized by EPA or the state to accept hazardous waste.
- Use the Hazardous Waste Manifest. A generator of hazardous waste is legally responsible for the waste at all times. Therefore, you must make sure that your transporter complies with all applicable federal and state regulations governing hazardous waste transport. It is also your responsibility to ensure that the facility to which the hazardous waste is sent is permitted and meets RCRA requirements for treatment, storage, and disposal of hazardous waste.

Under RCRA, shipments of some hazardous wastes are exempted from most requirements if they are being sent to a recycling or reclamation establishment. For small businesses, these wastes include dead automobile batteries and used oil. You must make sure that the facility that takes these wastes is recycling them.

Your state hazardous waste management agency can help you locate authorized hazardous waste facilities and transporters. You can also contact the National Solid Waste Management Association (202-659-4613), Government Refuse Collection and Disposal Association (301-585-2898) or your own trade association.

(continued on back panel)

How to Prepare Waste for Shipment

- Package and label your drums and containers as required by the U.S. Department of Transportation (DOT). Your state may have additional requirements for preparing hazardous waste for shipment. If you need assistance with these requirements, contact DOT (202-366-5580) or your state transportation agency.
- Fill out a Uniform Hazardous Waste Manifest to accompany each shipment.
- Your transporter can help you prepare the shipment. You still are responsible for the waste, however, and you must sign the Manifest.

What Is a Manifest?

The Uniform Hazardous Waste Manifest is a special form—EPA Form 8700-22—that must accompany shipments of hazardous waste. A copy of the Manifest and instructions for completing it are included in this brochure.

Federal law requires that any firm that produces more than 100 kilograms (220 pounds or approximately one-half of a 55-gallon drum) of hazardous waste (or one kilogram of acutely toxic waste) in a calendar month use a fully completed Manifest when shipping its hazardous waste off-site. Some states print their own version of the Manifest, using the state name and logo. Contact your state hazardous waste agency to find out if your state does; if so, you must use the state form. If you are sending hazardous waste out of state, you must use the Manifest of the state to which you are sending the waste. (If that state does not have its own Manifest form, use the Manifest form of the state in which you generated the waste.)

The Manifest must accompany the waste wherever it travels. Each individual handler of the waste must sign the Manifest and keep one copy. When the waste reaches its destination, the owner of that facility returns a copy of the Manifest to you to confirm that the waste arrived. If the waste does not arrive as scheduled, you should try to find out what happened. If you are unable to determine what went wrong, notify EPA or your state agency so that they can investigate and take appropriate action. You must keep copies of the Manifest for three years after shipment. Remember, it is your waste and you remain responsible for it.

How to Obtain Additional Copies of the Manifest

Contact your Regional EPA office or state agency for additional copies of the Manifest. Ask for EPA Form 8700-22. If your state (and, if you are shipping out of state, the receiving state) does not have its own version of the Manifest, you may purchase copies of the EPA Manifest from some commercial printers, or obtain copies from some hazardous waste treatment, storage, or disposal facilities.

Filling Out the Manifest

Instructions for completing the Manifest are provided on the back of the sample Manifest included with this brochure. New industry-specific inserts, also included in this brochure, contain information that can help you complete the Manifest for some of the wastes you produce. Your EPA Regional office, state agency, or the RCRA/Superfund Hotline can also provide assistance.

Waste Minimization: It's Good Business

Waste minimization means reducing the amount of waste your company generates. EPA strongly encourages the minimization of all wastes that pose risks to human health and the environment. Under RCRA, small quantity hazardous waste generators must certify that they have made a good faith effort to reduce the volume of hazardous waste they generate.

Many states have waste minimization programs that can help you identify cost-effective approaches to reducing the volume and toxicity of wastes. The EPA publication, *Waste Minimization: Environmental Quality with Economic Benefits* (EPA/530-SW-87-026) can also help you develop a waste minimization plan. The following is one industry-specific example of successful waste minimization practices.

Cleaner Drycleaning

Drycleaners can minimize hazardous waste produced by their operations through simple process changes, maintenance procedures, and efficient operating practices. The environmental "culprit" in the drycleaning process is solvent waste. Solvent wastes are used solvents that cannot be extracted from filters, and solvent residues that remain in the system after recovery and treatment. Even though recovery/recycling processes are built into the drycleaning process, solvent loss is possible due to leaks, spills, and poor management practices. Eliminating these problems can result in less waste and reduced spending for "fresh" solvents.

The benefits of a waste minimization program can be impressive. Below are examples of steps that some drycleaning facilities have taken to reduce wastes.

Process Changes

One drycleaning operation reduced its solvent wastes to a level well below national industry standards by implementing regular checks for system leaks and installing a system to recover additional solvent. The system involved azeotropic conditioning (a process which maintains a constant composition in the solvent) and a carbon absorption unit. With this new setup, the plant cleans four times as many clothes per drum of solvent. This translates into real savings for the facility: waste disposal costs are cut, and less new solvent must be purchased. Increased solvent recovery also means a cleaner environment.

Regular Maintenance

Leaks from worn equipment can easily go unnoticed unless routinely checked for signs of solvent loss. The following are a few of the areas that should be checked regularly for liquid leakage, and repaired if worn or damaged:

- hose connections, couplings, and valve machines
- filter head gasket and seating
- pumps and storage tanks
- cartridge filters

Efficient Operating Practices

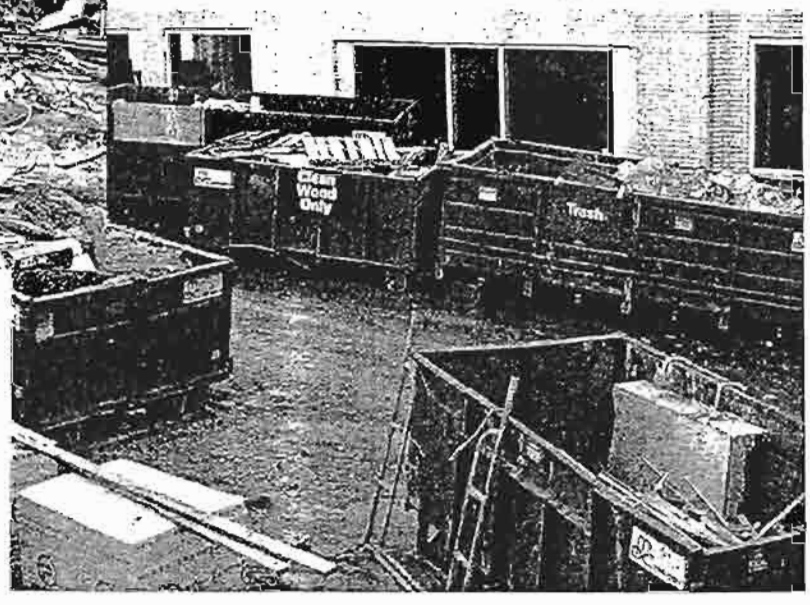
Improved operating practices can significantly reduce waste and save money. Drycleaners can eliminate unnecessary solvent loss by following simple procedures such as the following:

- Keep containers of solvent closed while not in use.
- Clean lint screens regularly to avoid clogging of the fans and condensers. The operation of the solvent recovery system is impeded if the condensers are caked with lint.
- Size the garment load correctly relative to the size of equipment. Overloading results in incomplete solvent extraction, while underloading increases the amount of solvent loss per garment.
- Consider purchasing newer, more efficient equipment.

Process-specific waste minimization options are continually being developed and tested. Simple, common-sense changes in facility operation can result in both substantial savings for generators and good news for the environment. For more information, contact your state agency or EPA Regional office, or access the Pollution Prevention Information Clearinghouse through the RCRA/Superfund Hotline.

Promoting building industry recycling:

A how-to guide



by Jim Goddard

Providing recycling education on construction and demolition debris helps an industry reach ambitious diversion goals.

Diverting building industry waste has become a priority for many recycling programs focused on achieving aggressive recycling goals. In Oregon's tri-county Portland metropolitan area, where construction waste accounts for about one-quarter of the solid waste generated, a successful four-year-old building industry recycling program has gained national attention.

The 1990 Solid Waste Management Plan adopted for the Portland metropolitan area directed Metro, the regional government, to develop a processing and recovery system for construction, demolition and land clearing debris. By 1991, however, private industry had developed more than enough processing capacity to divert the major components of the building industry waste stream. The Metro program quickly shifted gears from developing building waste processors to promoting existing facilities to the building industry.

The underlying assumption in the original management plan was "if you build it, they will come," so promoting the system had not yet been addressed. Liberated by the absence of a promotion plan, Metro was able to develop a strategy to meet immediate needs. The success of this strategy is reflected by the increase in recovering building waste, which went from virtually nothing in 1989 to over 40 percent of the construction and demolition debris generated in 1994. Building industry recycling accounts for almost one-third (220,000 tons) of waste diverted from landfills each year in the Portland region.

Write the book

The most important and successful component of the building recycling program in Portland was also the first step that was taken — providing builders with a booklet about the options for recycling building materials in the local area. Three editions and 21,000 copies later, I am confident that this is the most widely used source of information on the subject in the Portland metropolitan area. The latest version of the *Construction Site Recycling Guide* contains listings of recyclers grouped by the materials they process, with concise descriptions of material specifications and pricing. Armed with this information, most contractors can figure out what they need to do on their job sites to recover the scrap building materials they generate.

The simplicity of the booklet is deceiving, because it's more difficult to provide only essential information rather than everything under the sun. With contractors, less is more, especially when it comes from government. The many hours you spend compiling and checking the information will make it easy for contractors to understand recycling in their area. And contrary to the popular myth, size is important.

The booklet should be small enough to fit in contractors' filing cabinets (i.e., their shirt pockets) or in their desks (i.e., the glove compartment of their pickup trucks).

Get your hands dirty

Rolling up your sleeves and heading into the field will help you establish a building industry recycling program that works. Visit the companies that process construction and demolition debris as you develop the resource

Jim Goddard is the recycling system development supervisor in the Regional Environmental Management Department at Metro, the regional government with responsibility for solid waste disposal in the Portland, Oregon metropolitan area.

booklet. (I found that working at their sites for a day as a laborer helped me understand how their operations work.) Establish yourself as a resource for their businesses and draw on their experience as you develop your program. Also, find out how they have been promoting recycling to builders and which builders are already recovering building materials for recycling.

Then go to building sites and familiarize yourself with how builders work and how waste flows through a job. With permission, look through drop boxes and scrap piles. Talk to the crews and supervisors to find out their opinions on job site recycling. Don't be afraid to ask seemingly "stupid" questions about what they do with their waste and how much it costs them to dispose of it. You may be surprised to learn that they may not know. Most importantly, try to understand their perspectives about the scrap building materials they generate. Are they a nuisance? Expensive? Just one more thing that they don't have time to think about? Information such as this will help you identify how best to promote recycling in your area.

How did Metro do it? Metro started its journey by asking ardent local recyclers if they knew any builders who recovered building materials for recycling. We quickly found the hotbed, and then we talked to them, watched them work and sorted waste from their building projects.

What we have learned in the Portland area is that saving money is the primary incentive for recycling. Avoiding the $75-per-ton tipping fees for mixed waste motivates many builders to separate waste into components for which the tipping fee is much lower. To some builders, "doing the right thing" is a persuasive argument — as long as it doesn't cost any more than traditional disposal. Savvy contractors are finding a competitive edge by offering their clients the opportunity to trim disposal costs and use environmental construction methods.

Admittedly, searching for incentives is not a problem when disposal of waste from building a house can be equal to a week's wages. If your community doesn't have the "advantage" of high disposal fees, look for alternatives other than disposal. For example, heavy waste materials like concrete, block and brick are often mixed with other waste materials. If kept separate, they can be used as clean fill at almost no expense, instead of being hauled to a landfill. Lightweight materials like old corrugated containers take up a lot of dropbox space, but can usually be recovered easily. The important thing is to start with recovering one material that works in your area and then look for new opportunities as you go along.

Work with industry

It is not uncommon to hear recycling professionals suggest using the building permit process to add recycling requirements to construction regulations. But, as you may discover during site visits, this industry — like many others — does not look kindly upon the prospect of more regulation. In fact, the mere hint of "the 'R' word" can turn a friendly, helpful contractor into an adversary with pneumatic tools. The industry will respond to construction recycling programs only if they make sense. Otherwise, no amount of regulation will get builders to recover building materials for recycling.

One highly effective way to start promoting recycling programs is to develop a relationship with local building industry associations. Building industry associations function to inform their membership about developments and changes within the industry and to prevent the imposition of additional government regulations on the industry.

Depending on how you approach such associations, they can be either a great ally or an implacable enemy. Associations provide their contractor members with continuing education programs (usually continuing education hours mandated by the state), and a well-crafted construction industry recycling program can use an association's established education programs as an effective conduit to get the message out. The good news will be spread through newsletters, workshops and training classes. And associations benefit from positive publicity about an environmentally hot issue.

In 1992, Metro formed an Earth-Wise Building Committee to guide the development of its building industry recycling program and to provide an avenue for industry feedback. Members include representatives from the Home Builders Association of Metropolitan Portland, Oregon Remodelers Association, Associated General Contractors Oregon-Columbia Chapter and American Institute of Architects Portland Chapter, as well as haulers, recyclers and processors. This type of alliance is invaluable in developing program areas, testing ideas and concepts, and determining how to publicize recycling to the industry.

Promotional strategy

- ✔ Provide a convenient, easy-to-understand resource guide.
- ✔ Gain experience and perspective by visiting companies, working at construction sites and talking to crews.
- ✔ Form relationships with local building industry associations.
- ✔ Inform builders of their options for C&D debris recycling.

Educate — show and tell

The Earth-Wise Building Committee decided that educating builders about recycling options was the single most important element of Metro's building industry recycling program. The resulting program has included the following activities to facilitate recycling and demonstrate that construction recycling works in real-life applications:

- publicizing projects, through printed case studies and media coverage, of recycling and salvage efforts that have worked
- auditing the waste on a range of projects to identify differences and develop appropriate recycling methods
- providing training classes on resource-efficient building practices, including recycling and recycled building materials
- promoting "earth-wise" building practices at home shows and other events to create consumer demand for construction recycling
- working to help establish recycling services on a project where recycling hasn't worked in the past
- sponsoring construction recycling on visible projects by building associations
- developing techniques and equipment to make recycling more convenient
- developing recycling specifications for builders and architects to use on projects.
- demonstrating salvage techniques to divert usable materials.

Train the builders

We all know that training can make the difference between the success or failure of a business or a project. That's why Metro and its building association partners developed a training program to teach builders about recycling and other resource-efficient building techniques.

Once the builders have completed eight hours of training and have made a commitment to use the techniques in their projects, they are certified as "Earth-Wise Builders," in effect, an environmental seal of approval.

Aim for the long term

Although these efforts may seem daunting and time-consuming, they can create a public-private partnership that uses public resources efficiently and produces measurable and ongoing results.

Metro has spent about $250,000 on this program over the past four years and is currently decreasing its funding to a maintenance level. Metro's work provided an important jump-start for construction recycling, but industry is now ready to carry on with the effort. Programs like this not only save money, but they also give the building industry a better image. Government, too, can look better, and it can benefit from boosting its recycling rate and saving expensive landfill space.

RR

Construction and Demolition Landfill Recovery/Reuse Site Model

Minnesota Technical Assistance Program ■ MODEL

Minnesota public and private landfill operators are extending the life of their construction and demolition (C&D) cells by setting aside materials for reuse or recycling. A cooperative venture between landfills in Becker and Clay Counties resulted in the reuse of 89 tons of dimensional lumber and other construction items in 2003.

At a recovery/reuse site either facility staff or haulers separate items for customers to reuse. Items set aside for reuse at landfills are quickly taken by potential users. Materials such as concrete can be accumulated until there is enough to crush for sale or reuse on-site.

Use this four-step model to develop a recovery/reuse site at your facility.

1. Evaluate items for reuse
2. Review operating permit
3. Set up reuse area
4. Educate customers

Step 1: Evaluate Items for Reuse

Use your best judgement about what could be reused or recycled. Items in demand for reuse at some facilities include:

- Cinder/concrete blocks and bricks (whole and unmortared)
- Construction materials (unused) like sheetrock, shingles, ceiling and floor tiles
- Dimensional lumber
- Doors
- Fixtures (cabinets, ductwork, shelving)
- Flooring
- Wood beams

Some materials that can not be reused as their original form can be separated and accumulated until enough is available for processing and reuse on site for landfill maintenance.

- Brush, scrap wood, untreated lumber—grind and use as mulch or burner fuel
- Cinder/concrete blocks and bricks (broken or mortared)—crush for aggregate and use on roads
- Shingles—shred and place on roads to control dust

Step 2: Review Operating Permit

A modification of your operating permit may be needed before you begin processing material. Check with your Minnesota Pollution Control Agency staff contact. Additional storage standards, stormwater and soil water testing may be required as part of your permit.

Step 3: Set Up Reuse Area

Space availability and the conditions of your operating permit will determine where to locate items available for reuse.

Minnesota landfills have taken various approaches to sorting and storing items. The more comprehensive reuse programs have structures to hold materials and protect them from weather.

Storage sheds. If available, storage sheds offer the most protection from the weather.

Concrete bays. Concrete bays can be used to accumulate materials for processing and help contain runoff.

Reuse area. Use fence poles or posts to separate materials for collection. Items like windows and doors can be leaned against posts to help keep them clean.

If structures are not possible, establish separate areas to pile materials for reuse. Haulers can drop loads off at the appropriate spot.

Facilities whose staff cannot sort items for reuse have taken two approaches. Haulers are directed to areas with signage to show where items should be placed.

(continued)

MnTAP is funded by a grant from the Minnesota Office of Environmental Assistance to the University of Minnesota, School of Public Health.
Available in alternative formats upon request. Printed on recycled paper containing a minimum of 10% postconsumer waste.

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Or, when landfill staff visually check loads coming in, they look for reusable materials and ask the hauler to put them in the appropriate reuse area.

Step 4: Educate Customers

Liability is always a concern. One facility posted a sign at the reuse area that described the terms of use and had a liability waiver. Another landfill had clients sign a waiver form similar to ones used at a county household hazardous waste site. Contact MnTAP for sample waiver language.

Good signage is needed to direct haulers to where specific materials should be put. Signs can also let people know about items available for reuse.

Key to the success of a recovery/reuse site is working with your regular customers. Explain to them why you are separating materials for reuse. After one landfill operator explained the system to its biggest customer that company changed the way it loaded trucks at job sites to make unloading and separating at the landfill easier.

Get customer buy-in by educating customers about any incentives that your facility offers for using the recovery/reuse site. One site estimates the value of items set out for reuse and subtracts that from the load charge.

For More Information

MnTAP has a variety of technical assistance services available to help Minnesota businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution and reduce costs. Our information resources are available online at <mntap.umn.edu>. Or, call MnTAP at 612/624-1300 or 800/247-0015 from greater Minnesota for personal assistance.

Construction and Demolition Recycling Program

Introduction

Construction and demolition (C&D) debris includes concrete, asphalt, wood, drywall, metals, and many miscellaneous and composite materials. C&D debris is generated by demolition and new construction of structures such as residential and commercial buildings and roadways.

C&D accounts for a significant percentage of the municipal waste stream, with current estimates at 28 percent of the total tonnage. Its reduction will help meet the State-mandated diversion goal of 50 percent. The following projects involve different efforts among the public, industry, and the California Integrated Waste Management Board.

Board Programs

CalMAX Classified Ads. The Board's CalMAX (California Materials Exchange) program publishes free ads to help businesses find markets for materials traditionally discarded, including C&D materials. Listings are available online and are updated weekly. The hard-copy catalog is published quarterly. *Contact the CalMAX Hotline at 1-877-520-9703.*

R-Team—Business Assistance. The California Recycling Business Assistance Team, or "R-Team," is a network that assists businesses that use recycled feedstock in manufacturing. Assistance is provided for financial, marketing, technical, business, and permitting needs. The R-Team is a cooperative effort of the Board, California Trade and Commerce Agency, Business Environmental Assistance Centers, and the U.S. EPA. *Contact the R-Team at (916) 341-6600.*

Zone Loan Program. Low-interest loans are available for businesses starting or expanding recycling operations. The business must be located in a designated Recycling Market Development Zone (RMDZ). *Contact the R-Team at (916) 341-6600.*

Publications/Databases

Most of the publications and databases on the following pages are available both on the Internet and by mail.

To Access Information on the Internet. See "For More Information" at the end of this fact sheet.

To Receive Publications by Mail. Call the Board's Publications Clearinghouse at 1-800-CA WASTE, or from outside California, call (916) 341-6306.

Lists and Databases

C&D Recyclers—Processors & Receivers. A list of approximately 500 sites in California that receive construction and/or demolition materials for recycling or reuse. Sorted by county. Material categories include asphalt, concrete, brick, appliances, flooring, glass, drywall, paint, plastic, and wood. Pub. #431-96-017. Also a searchable database on the Board's C&D Web site. Contact: Tom Estes, (916) 341-6474.

Recycled-Content Building Construction Products. A list of approximately 450 manufacturers (and a few distributors) of recycled-content construction products sold in California. Most are also located in California. Sorted by county (or state). Product categories include aggregate, asphalt, masonry, structural, flooring, walls, insulation, fixtures, paint, roofing, and wood substitutes. Pub. #431-96-018. Also a searchable database on the Board's C&D Web site. Contact: Francisco Gutterres, (916) 341-6493.

Recycled-Content Product Database. A database of approximately 10,000 listings of recycled-content products, including C&D products. This is a searchable database available only on the Internet. Selected portions may be printed but not downloaded. Contact: Linda Hennessy, (916) 341-6606.

C&D Recycling—Organizations/Publications. A list of approximately 70 C&D recycling publications and associated organizations (nonprofit, business, and government). Pub. #431-96-019. *Contact: Sabra Ambrose, (916) 341-6499.*

Fact Sheets

Recycled Aggregate. A four-page overview of recycling concrete and asphalt into aggregate base, including *Greenbook* and Caltrans specifications, organizations, and siting considerations in California. Pub. #431-95-052. *Contact: Sabra Ambrose, (916) 341-6499.*

Asphalt Pavement Recycling. A four-page overview of recycling asphalt pavement back into asphalt pavement, including recycling methods, *Greenbook* and Caltrans specifications, organizations, and siting considerations in California. Pub. #431-95-067. *Contact: Sabra Ambrose, (916) 341-6499*

Drywall Recycling. A four-page overview of drywall recycling, including existing and potential markets, drywall processors in California, and a list of reports. Pub. #431-95-069. *Contact: Sabra Ambrose, (916) 341-6499.*

Caltrans and Recycled Transportation Products. A four-page overview of the types of recycled-content products that Caltrans allows, or could potentially allow, in State road projects. Includes guidelines for introducing a new product, and staff contacts. Pub. #431-97-012. *Contact: Francisco Gutterres, (916) 341-6493.*

Asphalt Roofing Shingles Recycling: Introduction. A three-page overview of processing asphalt roofing shingles for recycling into various potential products. Pub. #431-97-031. *Contact: Sabra Ambrose, (916) 341-6499.*

Asphalt Roofing in Aggregate Base. A two-page overview of recycling ground asphalt roofing shingles into aggregate base. Pub. #431-97-032. *Contact: Sabra Ambrose, (916) 341-6499.*

Asphalt Roofing in Asphalt Pavement. A four-page overview of recycling ground asphalt roofing shingles into asphalt pavement. Pub. #431-97-033. *Contact: Sabra Ambrose, (916) 341-6499.*

Asphalt Roofing in Cold Patch. A three-page overview of recycling ground asphalt roofing shingles into cold patch for potholes, sidewalks, utility cuts, driveways, ramps, bridges, and parking lots. Pub. #431-98-013. *Contact: Sabra Ambrose, (916) 341-6499.*

Why Use Recycled Plastic Lumber? A three-page overview of plastic lumber focusing on consumer issues and questions. Pub. #431-97-009. *Contact: Edgar Rojas, (916) 341-6518.*

Recycled Plastic Lumber: Research and Development. A three-page overview of technology and research around plastic lumber, including studies and contact names. Pub. #431-97-010. *Contact: Edgar Rojas, (916) 341-6518.*

Urban Wood Waste. A two-page overview that includes estimated quantities of wood waste generated from most construction and demolition operations as well as markets available for the processed wood waste. Pub. #443-95-057. *Contact: Francisco Gutterres, (916) 341-6493.*

Lumber Waste. A two-page overview of options and current practices being employed to reuse whole or remilled lumber generated from construction and demolition activities. Includes a list of organizations that salvage, remill, and/or regrade whole used lumber. Pub. #443-96-028. *Contact: Francisco Gutterres, (916) 341-6493.*

Job-Site Source Separation. A two-page overview of steps a contractor should consider that might enhance the likelihood of recycling wastes generated from construction or demolition activities. Pub. #443-95-066. *Contact: Francisco Gutterres, (916) 341-6493.*

Carpet. A two-page overview of carpet reuse and recycling practices and list of facilities that take used carpet. Pub. #443-96-027. *Contact: Rick Muller, (916) 341-6488.*

Specialty Manuals

Designing With Vision...A Technical Manual for Material Choices in Sustainable Construction. Discusses guidelines, recycled-content building products, product specifications, and waste prevention techniques during demolition and construction. Pub. #431-99-009. *Contact: Rick Muller, (916) 341-6488.*

Integrated Waste Management Disaster Plan. A comprehensive plan to help local governments in California divert demolition debris and other solid waste from landfills after a disaster such as an earthquake, flood, or fire. The plan was distributed to California cities and counties in March 1997. Pub. #310-97-006. *Contact: Sabra Ambrose, (916) 341-6499.*

Military Base Closure Handbook: A Guide to Construction and Demolition Materials Recovery. A guide to assist military bases in maximizing the amount of solid waste diverted from landfills. Solid waste includes concrete, asphalt, wood, drywall, metals, and green waste. The guide includes a discussion of the contracting and bid process. Pub. #433-96-074. *Contact: John Blue, (916) 341-6484.*

Case Studies

Presidio of San Francisco. A case study of the hand deconstruction and recovery of materials of Building 901 at the Golden Gate National Recreation Area (formerly the Presidio of San Francisco). The study chronicles the recovery of more than 78,800 board feet of lumber from a 2,450-square-foot building built in the late 1940s, and the sale of that lumber to showcase the cost-effectiveness of hand deconstruction. Available on the Board's C&D Web site and included in the *Military Base Closure Handbook* (see above). *Contact: John Blue, (916) 341-6484.*

CANMET Advanced Houses. A nine-page case study showcasing the use of recycled-content building materials and construction and demolition practices that reduce waste in the building of residential homes in Canada. Pub. #433-99-012. *Contact Francisco Gutterres, (916) 341-6493.*

Market Reports

The following reports have some major or minor connection to C&D materials.

Market Status Report: Urban Wood (October 1996). A six-page report discussing markets for urban wood, which includes pieces generated during the manufacturing or processing of wood products; harvesting or processing woody crops; wood debris from construction, demolition, and renovation; and wood used in packaging and transportation, such as pallets. Pub. #443-96-069.

Market Status Report: Recycled Inerts (October 1996). An 11-page report discussing recycled aggregate, asphalt pavement, asphalt roofing shingles, and drywall. Pub. #431-96-063.

Market Status Report: Ferrous Scrap (October 1996). A five-page report discussing primarily steel cans and "metallic discards" or large appliances. Pub. #421-96-061.

Market Status Report: Container and Plate Glass (October 1996). A nine-page report discussing container cullet and plate glass. Pub. #421-96-060.

Market Status Report: Postconsumer Plastics (October 1996). An eight-page report discussing markets for recycled plastics. Pub. #421-96-066.

Market Status Report: Waste Tires (October 1996). A six-page report discussing markets for recycled tires, including rubberized asphalt. Pub. #421-96-067.

Market Status Report: Urban Compost and Mulch (October 1996). A 12-page report discussing markets for compost and mulch made from urban feedstock. Pub. #421-96-068.

Market Status Report: Pavement (1993). A 67-page report covering concrete and asphalt pavement recycling markets, including sources, demand, and barriers.

Action Plan: Pavement (1993). A 30-page report on CIWMB strategies for improving markets for recycled pavement and aggregate base.

Other Resources

National Association of Home Builders (NAHB)

NAHB has several publications on construction waste management, including fact sheets and the field guides listed below. Available online at www.nahbrc.org or call NAHB at (301) 249-4000.

Residential Construction Waste Management: A Builder's Field Guide. Written for new home builders, the 30-page field guide presents several methods that builders can use for construction waste management and provides real case studies to support the recommended actions.

Waste Management and Recovery: A Remodelers' Field Guide. Written for residential remodelers, the 30-page field guide presents several waste management strategies and provides real case studies to support the recommended actions.

On-Site Grinding of Residential Construction Debris: The Indiana Grinder Pilot. A pilot project in Indiana determined that grinding and reusing the wood, drywall, and cardboard components of the waste stream can save builders money. Written for new home builders, the 35-page report describes servicing construction sites with a mobile grinder and reusing the processed material on-site as erosion control and as a soil amendment.

Community Environmental Council

Constraints and Opportunities: Expanding Recovery in the Demolition Industry. This 25-page paper discusses the economic, technical, and regulatory factors that influence salvage, identifies strategies for increasing recovery, and outlines recommendations to implement recovery programs.

For More Information

Call the Construction and Demolition Recycling Program at (916) 341-6470 if you have any questions.

Most of the information in this fact sheet, as well as additional related information, are available from the Board's Web site at www.ciwmb.ca.gov. See below for how to access specific information from the site.

C&D Home Page

For more information on the C&D program (or others), use the "Select a CIWMB Program" option on the Board's home page. Choose Construction/Demolition Recycling. Or type in the address directly—www.ciwmb.ca.gov/ConDemo/. You may want to bookmark this page.

Publications—Fact Sheets, Case Studies, and Market Reports

Many of the Board's publications are available online at www.ciwmb.ca.gov/Publications/. From the publications menu, choose from the topics on the left side ("Construction and Demolition" is one). You can also access C&D publications from the C&D home page (choose "Publications" on the left-hand side).

Databases

C&D Recyclers Database and Recycled-Content Construction Products Database. Both databases are listed on the menu on the left-hand side of the C&D home page.

Recycled-Content Product Database. Type in the address directly (www.ciwmb.ca.gov/RCP/ or from the Board's home page, choose "Databases" from the left-hand menu and choose the RCP database from the alphabetical list.

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Web site at www.ciwmb.ca.gov.

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"CHEJ is the strongest environmental organization today – the one that is making the greatest impact on changing the way our society does business."

Ralph Nader

"CHEJ has been a pioneer nationally in alerting parents to the environmental hazards that can affect the health of their children."

New York, New York

"Again, thank you for all that you do for us out here. I would have given up a long time ago if I had not connected with CHEJ!"

Claremont, New Hampshire

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