The National Demolition Association Reports:

Demolition Contractors Manage and Dispose of Waste Responsibly

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

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Presented by

National Demolition Association

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Executive Summary

Is demolition waste being managed in an environmentally safe manner; are additional regulatory controls needed? To help answer these questions, the National Demolition Association has been asked by the U.S. Environmental Protection Agency to provide information that will help the EPA and other agencies determine what type of regulations will be sufficient to ensure environmental protection for landfills serving the demolition industry.

National Demolition Association's Conclusions:

The majority of waste disposed at demolition landfills is relatively inert. Demolition waste is primarily a mixture of wood, concrete, bricks, glass, metals, roofing materials, plastics, and dirt which cannot be economically recycled. These materials are not a source of significant environmental risk when managed appropriately.

State-of-the-art demolition landfills pose no significant environmental risk. The National Demolition Association's studies show that demolition landfills, when monitored and operated consistent with industry guidelines, provide appropriate environmental safeguards. Leachate representative of such facilities meets National Primary Drinking Water Standards and can be managed so that it does not pose a significant environmental threat.

National Demolition Association Research: Those conclusions could be arrived at only after a number of other questions were asked and answered.

How does the demolition industry manage project sites and segregate waste streams for proper handling?

How are demolition landfills currently regulated?

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

What are the characteristics of leachate from demolition landfills?

The firm of Gershman, Brickner & Bratton, Inc. (GBB), consultants with particular expertise in the study of construction and demolition waste management, has completed a nation-wide research project for the the National Demolition Association which provides an up-to-date compilation of available information needed to address these questions.

This report summarized the results of GBB's research effort and presents the National Demolition Association's position based on this current data.

Background

The National Demolition Association

For more than two decades, the National Demolition Association has been a source of information about the demolition industry, offering its professional and experience-based insight to governmental regulators, and helping to ensure that environmentally responsible and safe practices are standard practice for the demolition industry.

As the recognized voice for the demolition industry, the National Demolition Association is often asked for information about topics of current focus, concern, and significance. This report has been prepared in response to requests from the U.S. Environmental Protection Agency for information about the character of demolition waste, methods by which it is managed, the quality of leachate from demolition landfills, associated environmental risks, and for the National Demolition Association's conclusions and recommendations regarding the type of regulation and control appropriate for demolition landfills.

Sierra Club vs. Browner

In settlement of a lawsuit brought by the Sierra Club, the U.S. EPA agreed to promulgate revised criteria for nonmunicipal solid waste facilities in the coming months. Demolition landfills which receive for disposal a very controlled and limited wastestream are one type of facility which could be subject to such regulations.

The EPA has requested the National Demolition Association to provide information that will help address the question of whether regulations similar to EPA's Sub-title D standards for municipal solid waste landfills are needed to ensure environmental protection for landfills serving the demolition industry – essentially to answer the question, are demolition wastes managed and disposed of responsibly?

National Demolition Association's Databases

For decades, the National Demolition Association has supported the environmentally responsible management of demolition wastes by the industry. National Demolition Association experience has led to it's firm belief that these efforts have resulted in safe management of demolition wastes. However, National Demolition Association's knowledge of the effectiveness of the industry's efforts is not the same as being able to demonstrate and document:

- What **materials** are being landfilled?
- What type of **regulations** apply to demolition landfills across the U.S.?
- What are the **characteristics of leachate** from demolition landfills?

In order to provide the best available base of information to address these questions, the National Demolition Association sought an independent third-party to perform the necessary research effort. The firm of Gershman, Brickner & Bratton, Inc. (GBB), recognized experts in the study and management of demolition waste, was retained to complete a nation-wide research program that would compile and review databases on the characteristics of demolition waste, applicable state regulations, and leachate characteristics. These research efforts and their resulting resource documents are identified in the table below.

Table 1: National Demolition Association Databases and Reports

Topic	Research Approach	Resource Developed
Characteristics of construction and demolition wastes	Complication of published reports and articles about the composition of materials delivered to demolition landfills for disposal	*C&D Waste Characterization Database, Volumes 1&2*, prepared for the National Demolition Association by GBB, February, 1994
Regulations governing design, operation, monitoring, and closure of demolition landfills	Survey of 50 states	*State Regulatory Database, Volumes 1&2,* prepared for the National Demolition Association by GBB, August, 1944
Characteristics of leachate from demolition landfills	Survey of 50 states, published reports and articles, records solicited from operating facilities	*C&D Waste Landfills Leachate Quality Data, Volumes 1&2,* prepared for the National Demolition Association by GBB, February, 1995
Analysis of collected leachate data	GBB evaluation of collected information	*Preliminary Report on Demofill Leachate Quality,* prepared for the National Demolition by GBB, February, 1995

The databases and technical reports developed through GBB's efforts are available through the NATIONAL DEMOLITION ASSOCIATION; more information about how to obtain these resource reports can be found on the last page of this document.

How does the Demolition Industry Manage Project Site 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 know 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 a more formal site audit is performed by the site owner or a third party environmental consultant.

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 walls, 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 National Demolition Association. 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 characteristics 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 National Demolition Association has identified an inventory of the operating practices and design characteristics that it considers to be representative of 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 National Demolition Association 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 Waste	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 National Demolition Association 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 National Demolition Association 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 National Demolition Association 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 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 contaminant's 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	5.03	ND-0.81	<0.01-0.03
Volatile Organics (mg/L)			
Trichloroflouromethane	N/A	<0.02-13	<0.02-0.025
1,2 Dichloroethan	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-1800	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 (mmhos/CM	—	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 Demolition Association , prepared by Gershman, Brickner & Bratton, Inc., February 14, 1995.

[2]MCL = Maximum Contaminant Level – National Primary Drinking Water Standards.

[3]National Secondary Drinking Water Standards.

[4]Includes data from facilities which 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	Surrogate MSW Leachate Data	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-Ñ140	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	730-170
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 Lanfill Leachate Study,* December 1991.

[4]Consolidated database from Table 3.

DNP = Data Not Provided in referenced report.

National Demolition Association Conclusions and Recommendations

National Demolition Association's development of nation-wide databases regarding demolition waste composition, state regulation of demolition landfills, and demolition landfill leachate characteristics was prompted by requests for the best available up-to-date information that could help guide development of federal and state regulations applying to demolition landfills. National Demolition Association has concluded that data representative of state-of-the-art demolition landfill leachate does exist and is the best information representative of industry impacts. The National Demolition Association's database and associated research effort should be considered by regulators as a comprehensive attempt to reconcile several different databases, documents and opinions on the use of published construction/demolition landfill leachate databases in the effort to help formulate regulatory policy.

National Demolition Association's waste characterization database documents that a vast majority of waste received by demolition landfills is relatively inert. Demolition wastes are predominantly a mixture of wood, concrete, brick, dirt, metals, roofing materials, glass, plastics and other non-recyclable wastes.

Some have suggested that demolition lanfills must meet EPA standards for Sub-title D municipal solid waste landfills, a view based in part on data regarding demolition landfill leachate quality from studies which pre-date National Demolition Association's 1994 review and database compilation. It cannot be overemphasized that the extensive National Demolition Association research effort found that landfills that used to be "old MSW dumps" or that have been the recipients of unchecked, unauthorized or illegal waste generate poor quality leachate. Unfortunately, the records for some of these sites are still being considered as part of the database being relied on to support the development of new, more stringent regulations for demolition facilities. However, as National Demolition Association's database shows, leachate from state-of-the-art demolition landfills and MSW landfills are not similar in concentration or composition, and thus should not demand similar regulatory regimes.

These findngs support National Demolition Association's conclusion that properly designed, well

maintained and operated demolition waste landfills are the most economical and environmentally sound method to manage that portion of the demolition industry's waste which cannot economically be recycled. National Demolition Association recommends that the standards and practices outlined in Table 2 be the basis for defining the manner in which demolition landfills can remain a viable and economic alternative for disposal of demolition wastes. In all cases, the National Demolition Association believes that the development of effective regulations for demolition landfills must begin with a clear definition of the materials which constitute "Acceptable Waste" for demolition landfill disposal. In addition, every facility must have an Operations Plan which includes provisions to effectively exclude unacceptable wastes and provide for their proper management.

National Demolition Association believes that just as the disposal of significant quantities of hazardous waste, batteries, waste oils, and other special wastes have been successfully reduced and/or eliminated from MSW landfills, yard waste composting sites, and waste-to-energy facilities, it is possible to work through demolition contractors, home builders, general contractors and other construction/demolition waste generators to eliminate inappropriate materials from demolition landfills.

In response to the challenge of handling the large amount of demolition debris generated in the United States in an environmentally safe manner, National Demolition Association members recycle millions of tons of waste annually, creating products for use in manufacturing, road building and maintenance, landscaping, nursery production, and more. However, not all wastes can be recycled, therefore, landfilling remains an integral, necessary component of the industry's appropriate waste management options. The demolition landfill is considered by the National Demolition Association to be a viable means of disposal for construction/demolition waste. For years, these facilities have accepted construction/demolition wastes and, when managed properly, pose no significant threat to the environment.

Databases, Reports, and Other Information

The databases and technical reports described in this document are available from the National Demolition Association for the nominal cost of reproduction.

- *C&D Waste Characterization Database, Volumes 1&2*, prepared for the National Demolition Association by GBB, February, 1994
- *State Regulatory Database, Volumes 1&2,* prepared for the National Demolition Association by GBB, August, 1994
- *C&D Waste Landfills Leachate Quality Data, Volumes 1&2,* prepared for the National Demolition Association by GBB, February, 1994
- *Preliminary Report on Demofill Leachate Quality,* prepared for the National Demolition Association by GBB, February, 1995

About the National Demolition Association

The size and experience of its membership have made the National Demolition Association of a driving force and voice for the demolition and recycling industry for nearly a quarter century. The National Demolition Association was formed in 1972 as a non-profit organization to foster communication between the public, governmental regulators and contractors engaged in the demolition industry. The National Demolition Association sponsors educational programs to increase public understanding of all aspects of the demolition industry, supports research efforts regarding issues of concern, and acts as an information clearinghouse for its members.

For copies of these documents or for additional information about the National Demolition Association or about the demolition industry, please call or write:

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