BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
CLEAN CONSTRUCTION OR DEMOLITION DEBRIS FILL OPERATIONS (35 ILL. ADM. CODE PART 1100	)	R06-19

COMMENTS OF THE ILLINOIS ATTORNEY GENERAL ON RULEMAKING R06-19

LISA MADIGAN, Attorney General of the State of Illinois, hereby files the following comments with the Illinois Pollution Control Board ("Board"), regarding the Illinois Environmental Protection Agency's proposed rules in this matter, which it filed with this Board on November 21, 2005.

GENERAL COMMENTS

The Office of the Attorney General ("OAG") would like to preface these general comments with some background on the State's enforcement experience with construction and demolition debris sites. Over the course of the past several years, the OAG has expended a significant amount of enforcement resources on such sites. By way of example, the OAG has filed or pursued numerous circuit court civil enforcement cases in which it sought injunctions for violations at construction and demolition debris sites. The OAG has also pursued criminal enforcement cases involving such sites as well. In 2004, one individual was indicted and pled guilty in Alexander County to criminal disposal of construction and demolition debris wastes. In addition, an individual and two corporate entities were indicted in Cook County in 2002 for criminal violations at a construction and demolition debris site.

This is in no way to imply that all such operations are problematic; indeed, such operations are necessary, beneficial and pose relatively low risk when properly operated. However, it must be recognized that these operations do pose significant challenges in crafting a regulatory scheme that is adequately protective of the public's health and the environment.

As the Illinois EPA witnesses have testified in these proceeding, much of the materials entering these facilities will frequently resemble soil. January 26, 2006, Hearing Tr. at 54. The nature of these materials can make it difficult to consistently ensure that incoming materials are within the definition of clean construction and demolition debris ("CCDD"). It has been the OAG's experience that unscrupulous operators take advantage of this fact and frequently accept loads of construction and demolition debris that appear to consist of soils, but which also contain other materials which are not properly disposed of at CCDD fill facilities.

The OAG is also aware of instances of "sham recycling" of CCDD, wherein unscrupulous operators will engage in activities which appear to be consistent with recycling operations, such as the separation and segregation of CCDD materials, and the use on site of sorting and separation machinery. However, such activities are essentially a ruse to ward off closer regulatory scrutiny until the persons operating these facilities shut down such operations, leaving sometimes substantial piles of un-recycled material behind. While such operations may actually engage in some degree of recycling, the end result is an abandoned stock pile of debris and other, possibly hazardous, materials.

SPECIFIC COMMENTS[1]

[1] Finally, each of the following specific comments includes a discussion of the anticipated costs and projected benefits associated with the comment. Due to time constraints, the anticipated costs discussed below are preliminary in nature and are not

Comment 1 - Scope of Load checking program (Proposed Section 1100.205)

The Board should adopt a load checking program which is designed to prevent non-CCDD materials from being accepted and disposed of at CCDD fill facilities. The proposed rules require routine load checking with an inspection and use of a photo ionization detector ("PID"), a flame ionization detector ("FID") "or other devices approved by the Agency," as part of the load checking program. Proposed Section 1100.205.

The OAG supports the use of such devices. However, it should be recognized that, while effective, a PID or FID will only detect the presence of volatile organic contaminants contained in the materials being brought to a CCDD fill facility. The potential for metals contamination has been documented in CCDD-type materials. Facilities should at least screen for the presence of lead, chromium and cadmium, which are among the types of metals which are commonly found in CCDD.

However, it may be difficult to detect metals contained in CCDD materials if a load of bulk material entering a CCDD fill facility is only visually inspected. Accordingly, the OAG believes that in order to ensure that CCDD containing metals are not disposed of at CCDD facilities, the final rules adopted by the Board should include a requirement that each load of bulk material entering a CCDD fill facility will be scanned with an X-ray fluorescence ("XRF") analyzer for the presence of metals.

In addition, the OAG is concerned that asbestos-containing materials ("ACM") may also be found within materials sent for disposal to CCDD fill facilities. The OAG has undertaken

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intended to be exact predictions of the projected costs of implementing a given comment. The estimated costs are not all inclusive and site specific parameters may cause the costs to change.

many enforcement cases involving asbestos-containing materials being disposed of at sites taking construction and demolition debris.

The OAG therefore believes that the Board should expand the proposed requirements under Proposed Section 1100.205 to include a comprehensive load checking program. Such a program should address the potential for metal and asbestos contamination, in addition to screening for volatile organic contaminants. We also recommend that all personnel conducting load checking inspections at CCDD facilities undergo training that will allow them to visually identify the types of materials associated with asbestos. If incoming material is identified as likely asbestos, the material should be sampled, analyzed and, upon the confirmation, such loads should be rejected.

The OAG opposes the Illinois Association of Aggregate Producers' ("IAAP") proposal that PID/FID devices used to detect organic contaminants be calibrated to account for specific background conditions present which may be present at a CCDD fill facility. The OAG is concerned that the adoption of the IAAP's revision to Proposed Section 1100.205 would essentially result in an "undercounting" of the amount of organic contaminants contained in a load of material due to the presence of contaminants at the site. The OAG supports and joins in the statements of the Illinois EPA at the first hearing on this matter. January 26, 2005 Hearing Transcript at 50.

Estimated Costs and Benefits of Implementing these Requirements

Under Illinois EPA's proposed rules, a CCDD fill operator would be obliged to use either an FID/PID. Our comments endorse the use of such devices. However, we are also proposing that CCDD fill operators be required to inspect each load for the presence of metals with an XRF analyzer. While this proposal would result in some moderate additional costs,

such as the $35,000 cost of the device (this cost includes training), operation and maintenance costs to keep these devices functioning properly, and potential increased labor costs associated with the additional time spent checking loads with the XRF analyzer, these costs are clearly outweighed by the benefits to the environment and the public health. In particular, the OAG believes that the use of such a device would serve as a "gatekeeper" which will decrease the likelihood that waste or other improper material is not disposed of at CCDD fill operations.

We have also endorsed Illinois EPA's proposed requirements that persons inspecting loads sent to CCDD fill facilities be trained in the identification of non-CCDD material. At present, Proposed Section 1100.205(g) requires the owner or operator to "ensure that all appropriate facility personnel are properly trained in the identification of material that is not CCDD." If the proposed rule does not include training to identify ACM, our comment could result in additional costs for this training to the operation's owners or operators. Again, due to the environmental and health dangers posed by ACM, the benefits of this training far outweigh the potential marginal costs.

Finally, our proposed comments could result in some additional costs for sampling and analysis in those instances where an inspector determined that some alleged CCDD did not meet the regulatory definition of CCDD. This sampling and analysis are clearly needed to adequately protect the public's health and the environment.

Comment 2 - Leachate / Contingent Groundwater Sampling Requirements

The OAG notes that, as currently proposed, these rules do not include requirements for any form of groundwater monitoring or leachate sampling and analysis. It is the OAG's position

that the Board should include such requirements in the final rules it adopts through this rulemaking. There are several reasons why such requirements should be included in the final rules. First, as discussed above, the Illinois EPA's proposal includes load checking only for volatile organic compounds. This does not insure that other substances, such as metals, will not be present in the incoming loads. Also, the OAG's enforcement experience to date indicates that it is likely that inappropriate materials will be sent to CCDD facilities. As the regulations are currently proposed, if contaminated materials do enter a facility and contaminate groundwater, the State will be left without any means to detect or to address such contamination. In a worst case scenario, contamination may not be detected until it impacts a public water supply or private potable water well.

The inclusion of such a requirement in the rules adopted by the Board would be consistent with similar regulations in a majority of other states. At least twenty seven other states now require some form of ground water monitoring at CCDD disposal sites within their jurisdiction. Several of these states border Illinois, specifically, Kentucky, Michigan, Missouri, and Wisconsin. *See* Clark, Jambeck & Townsend, *A Review of Construction and Demolition Debris Regulations in the United States* (*"Review"*), at page 152, a copy of which is attached and incorporated by reference as Exhibit 1 to these comments. Other states which impose ground water monitoring requirements for CCDD disposal sites include California, Florida, New Jersey, New York, Pennsylvania, Texas, and Virginia. (*Review*, at page 152.)

Not only is groundwater monitoring of CCDD disposal sites a widely accepted requirement in other states, the Board has already imposed similar requirements for landfills which accept inert waste. Specifically, Sections 811.202 and 811.206 of the Board's Regulations establish requirements for sampling and determining whether leachate at inert

waste landfills is contaminated. 35 Ill. Adm. Code 811.202 and 811.206. The Board can use these already-existing regulations as a model for imposing similar requirements for CCDD landfills. Such rules would provide a means for detecting contamination. It should be noted that upon a determination of contaminated leachate, the inert waste rules provide that the facility shall comply with all of the requirements of Part 811, Subpart C, regulating chemical and putrescible waste landfills. Accordingly, it is the OAG's position, based upon its experience prosecuting cases such as *People of the State of Illinois v. J.T.Einoder,* No, 00 CH 10635 (Cook County) that groundwater assessment, monitoring and remediation are essential safeguards which must be implemented at CCDD disposal facilities. [2]

However, because CCDD facilities pose less of a risk of contamination problems than municipal solid waste landfill facilities ("MSWLFs"), the final rules should include groundwater standards that come into effect only after contaminated leachate has been discovered at such facilities. Therefore, as long as a facility maintains leachate within the applicable standards, more comprehensive groundwater measures will not be required. The OAG proposes that groundwater assessment, monitoring and corrective action requirements apply upon a determination of contaminated leachate, as described in Section 811.202. This could be governed by specific reference to 35 111. Adm. Code 811.315-811.320 and 811.324.

We propose the addition of the following language, for insertion at a suitable location within the proposed rules:

Section 1100.XXX Leachate Sampling

[2] This case involves a former CCDD facility at which groundwater contamination has now been discovered.

a) The owner or operator shall conduct leachate sampling in accordance with the requirements of 35 Ill. Adm. Code 811.202 and 35 Ill. Adm. Code 811.206(a), (b) and (c).

b) If the results of testing of leachate samples in accordance with subsection (a) confirm that the leachate is contaminated as defined in 35 Ill. Adm. Code 810.103, the operator shall notify the Agency of this finding, in writing, before the end of the business day following the finding. In addition, the facility causing the contamination shall be subject to the requirements of 35 Ill. Adm. Code 811.315 through 811.320 and 811.324 through 811.326 of the Standards for Putrescible and Chemical Waste Landfills of Part 811, Subpart C.

c) All records of such sampling required by this Section shall be maintained pursuant to Section 1100.210 and included in the annual report submitted to the Agency pursuant to Section 1100.211.

The OAG believes that while it is proper for the Board to establish a lesser degree of regulatory controls for the operation of CCDD fill facilities than those which it has already established for municipal solid waste landfills ("MSWLF"), it is nevertheless appropriate to establish controls that will minimize the threat that such facilities potentially pose to human health and the environment.

Estimated Costs and Benefits of Implementing these Requirements

Requiring groundwater monitoring wells and sampling will impose additional costs on CCDD fill operators. Such additional costs, which are difficult to quantify, would be related to the performance of geotechnical studies and hydrogeological studies, as well as Phase I Environmental Site Assessments of the Site.

Other costs would be incurred during the installation of groundwater monitoring wells at each CCDD fill operations. It is estimated that it would cost somewhere between two thousand dollars ($2,000.00) to three thousand dollars ($3,000.00) per well to install. The number of wells is wholly dependent on the size of the fill operation.

Under our proposed regulations, CCDD fill operators would also incur costs associated with routine groundwater sampling activities. Initial sampling would cost $1,200.00 to $1,500.00. Later samples would likely decrease in cost. The number of samples is dependent on the number of wells.

The benefits to be realized by requiring these measures are significant. First, inclusion of such measures in the final rules would identify whether leachate is contaminated and whether contaminants are leaching from the site, before they adversely impact the surrounding area. Second, earlier detection of leachate allows for earlier and less costly remediation. Finally, earlier detection translates into a higher degree of protection for the public and the environment from the possible negative impacts of CCDD fill operations.

Comment 3 – "Other Materials"

During the first hearing in this matter, mention was made of the possibility of other wastes being taken at CCDD fill sites. January 26, 2006 Hearing Transcript at 57-58. It is unclear whether this may contemplate the disposal of wastes other than CCDD in clean fill facilities. It is the OAG's position that the Environmental Protection Act ("Act"), 415 ILCS 5/1 *et seq.* (2004), does not allow the disposal of wastes of any kind at CCDD fill facilities. The Act clearly limits the materials that these facilities can accept to CCDD only. These facilities may only accept those specific materials which fall under the waste exclusion of Section 3.78 of the Act. 415 ILCS 5/3.78 (2004). The Board cannot legally use this rulemaking to expand the class of materials that may be accepted for disposal at CCDD facilities beyond those already designated by Section 3.78 of the Act.

Estimated Costs and Benefits of Implementing these Requirements

This proposed comment simply seeks clarification about what would be considered "other materials." Thus, there is no associated cost.

Comment 4 - Signatories for Limited Liability Companies (Proposed Section 1100.303)

The OAG suggests that Section 1100.303 should include a subsection addressing required signatories for limited liability companies ("LLC"), to take into account that increasingly prevalent entity. We suggest that a member sign for a member-managed LLC and a manager or member sign for a manager-managed LLC.

Estimated Costs and Benefits of Implementing these Requirements

This would not impose any additional costs on CCDD fill owners and operators. It would have the clear benefit of ensuring that Illinois EPA knows who the legally responsible party is for such sites.

Comment 5 – Notification Requirements (Proposed Section 1100.302)

The OAG opposes the comment of the IAAP regarding public notice. Written notice as proposed in Section 1100.302 is necessary and appropriate to directly inform both local elected officials, as well as to indirectly inform local residents of communities which may find themselves hosting CCDD operations in the future.

It is the OAG's position that, as currently drafted, Section 1100.302, will provide local elected officials with direct and timely notice of permit applications pending before the Illinois EPA. As the Illinois EPA noted in the Statement of Reasons ("SOR") which it filed in support of this regulatory proposal, "[t]he notice requirements for the CCDD fill permit . . . helps assure that the officials are made aware of the activity so that they can better respond to their constituents' concerns." (SOR, at p. 3.) As a constitutional office which each year receives

hundreds of inquiries from Illinois citizens regarding environmental issues impacting their communities, the OAG believes that a regulatory requirement like Section 1100.302 provides the citizens of Illinois with critical information that could affect their respective communities.

Estimated Costs and Benefits of Implementing these Requirements

There are no additional costs above those associated with Illinois EPA's proposal. The benefits of this proposed comment are described above.

Comment 6 - Fill Elevation (Proposed Section 1100.204)

The OAG opposes the comment of the IAAP regarding the height of the fill. This proposal inserts language into the proposed Section 1100.204 allowing for the Agency to approve elevations higher than the prior existing highest point of adjacent elevation for site development or reclamation.

Public Act 94-0272 prohibits the placement of CCDD at elevations higher than the high point of elevation in the surrounding property. Therefore, this inclusion is clearly not authorized by law. However, even if such authorization existed, the language proposed would be insufficient. It does not address such basic issues as side slope stability and other considerations.

Estimated Costs and Benefits of Implementing these Requirements

The AGO's comments merely oppose IAAP's suggested revisions to Illinois EPA's proposed language.

Comment 7 – Lack of Financial Assurance

The OAG is troubled by the proposed regulations failure to require any sort of financial assurance by CCDD facility operators. In this regard, the OAG notes that the vast majority of states which have adopted regulations governing the operation of CCDD facilities have seen fit

to include some form of financial assurance requirement. *See, Review*, at p. 146. Moreover, most of the States bordering Illinois currently require CCDD facilities to provide some form of financial assurance. (*Id.)*

Estimated Costs and Benefits of Implementing these Requirements

There are a variety of financial assurance requirements which could be imposed by the Board. Here, we provide two examples of possible financial assurance requirements which are included in USEPA guidance: 1) Letter of Credit ("LOC"); an LOC can typically be obtained for between .5% - 1.0% of its face value; 2) Performance or Surety Bond. The cost of such bonds typically runs between 2% to 4% of the face value of the bond, per year. The ultimate cost of either option would vary, depending on the estimated cost to remediate the site.

This requirement would significantly benefit the State of Illinois and the communities surrounding these facilities by ensuring that the owner or operator sets aside an appropriate amount of money for future remediation costs.

Comment 8 – Items Prohibited From Inclusion in CCDD

As currently proposed, the regulations do not include a list of items which are typically found in demolition debris and should be banned from any CCDD fill site. The OAG requests that the Board include such a list in the final rules which it adopts and would specifically request that the following non-exclusive list be included in the final rules:

- fluorescent lamps
- mercury-containing electrical devices and apparatus
- electrical transformers and ballasts

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A Review of Construction and Demolition Debris Regulations in the United States

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Construction and demolition (C&D) debris comprises a significant portion of the solid waste stream in the United States. Because C&D debris is largely regulated at the state level, the requirements for C&D debris disposal facilities vary from state to state. A review of state regulations was conducted to determine C&D debris disposal facility requirements, including specific requirements for liners, leachate collection, groundwater monitoring, location restrictions, operator training, waste spotters, final cover, financial assurance, and recycling. This review found that little consistency exists in the regulation of C&D debris facilities among states. Twenty-three states require liners, while 27 require groundwater monitoring. Seventeen states reported having regulations pertaining to recycling C&D debris. Several states are currently in the process of reviewing and updating their C&D debris regulations, an indication of the greater recognized importance of this fraction of the solid waste stream.

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Once dismissed as a small segment of the solid waste stream, construction and demolition (C&D) debris (often referred to as C&D waste or simply as C&D) is a topic of growing interest for the solid waste industry. C&D debris, household and commercial refuse, and yard trash are often lumped together and described as municipal solid waste (MSW). C&D debris differs in both physical form and chemical content from other MSW components, and because of its unique management issues and challenges, it has become more common to distinguish C&D debris as its own separate waste stream. Unlike household and commercial refuse, C&D debris is not heavily regulated under U.S. federal regulations, leaving individual states to develop their own appropriate regulatory strategies. State environmental agencies have adopted a variety of approaches for regulating C&D debris. While C&D debris recycling is becoming more common, landfilling is still the predominant practice, and, as such, most state regulatory programs focus on land disposal of C&D debris. The promulgation of regulations pertaining to C&D debris recycling, however, is a growing trend.

This paper presents the results of a survey of U.S. federal and state regulations pertaining to C&D debris. The objective of this review is to provide useful information to those involved with the generation, management, or regulation of this waste stream. The information summarized was gathered by the authors through a review of the regulations and through contacts with relevant regulatory officials. The rules themselves or the appropriate agency, however, should be consulted as needed, as regulations change and may be subject to interpretation. References for all regulations are cited at the end of this paper.

C&D DEBRIS BASICS

C&D debris results from the construction, renovation, and demolition of buildings, roads, and bridges and often includes material produced during site preparation (e.g., land-clearing debris). Residential, commercial, industrial, and governmental sectors all contribute to this waste stream. A U.S. Environmental Protection Agency (U.S. EPA)-sponsored study estimated that 123 million metric tons of building-related C&D debris, (1.27 kg [2.8 lb] per person per day) were generated in the United States in 1996,[14] compared to 190 million metric tons (1.95 kg [4.3 lb] per person per day) of non-C&D debris MSW produced in the same year.[15] If the amount of debris generated from non-building-related C&D debris sources (e.g., concrete and asphalt from roadwork) were added, the total amount of C&D debris would likely exceed the total amount of other MSW sources.

While the composition of C&D debris varies as a function of the activity generating the waste, the major components include wood, concrete, metal, roofing material, cardboard, gypsum wallboard, and soil. Other components, such as packaging, electrical wire, and insulation, also occur, as do small amounts of other materials that are not classified as C&D debris (e.g., food wrappers, hazardous waste). The exact amount of landfilled C&D debris is not known, but a large fraction of C&D debris, especially mixed building-related debris, is land disposed.[14] Large, homogeneous sources of debris (e.g., concrete, asphalt pavement) are frequently recycled. Some mixed C&D debris is also recycled, with separation occurring at central processing facilities. Recent efforts to separate and recycle construction debris at the construction site,[24] as well as to deconstruct buildings and reuse building components,[27,59] account for a small but growing management option.

Historically, C&D debris has been considered to be relatively inert and composed of materials that will not pose an undue environmental risk, even when managed in uncontrolled disposal facilities. Various potentially dangerous materials, however, are now recognized to occur in some sources of C&D debris. Heavy metals such as lead (paint, pipe solder, flashing, batteries), mercury (lighting, electrical switches, thermostats), cadmium (batteries, paints), and arsenic (treated wood) are common ingredients of many building components.[54] Polychlorinated biphenyls are still encountered in many older lighting ballasts, transformers, and capacitors, as well as numerous other materials.[7] Asbestos building products include floor tiles, roofing mastic, pipe insulation, and cement siding.[6,17] As a result, the unsafe management of C&D debris can pose a risk to human health and the environment from its generation (e.g., the demolition process) to its final disposition (e.g., disposal in a landfill). Even the primary building components themselves (e.g., drywall, wood) can impact the quality of groundwater underneath an unlined C&D debris disposal facility.[60,65] The growing awareness of the potential risks posed by C&D debris has spurred the development of regulatory programs to limit unsafe management practices.

Federal Regulations Governing C&D Debris

The U.S. EPA does not specifically regulate C&D debris. The Resource Conservation and Recovery Act (RCRA) governs the U.S. federal solid waste management system. Under RCRA, C&D debris is a solid waste and therefore can potentially be a hazardous waste. C&D debris is not included as a listed hazardous waste. Several building materials do, however, have the potential to be characteristic hazardous wastes. Discarded oil-based paints and solvents from a construction project would be ignitability characteristic hazardous wastes. Some batteries and cleaners meet the definition of corrosivity characteristic hazardous wastes. Building materials containing elements

such as lead, mercury, cadmium, and arsenic may be toxicity characteristic (TC) hazardous wastes.[54] Not only are some discrete components found in buildings hazardous wastes, but the buildings themselves may be hazardous wastes if painted or contaminated with toxic chemicals (e.g., coated with lead-based paint). The relatively small mass of toxic elements compared to the rest of the building materials makes it very unlikely, however, that an entire structure would require management as a hazardous waste.

The RCRA hazardous waste regulations can impact the management of C&D debris in a number of ways, depending on the amount generated. A generator producing more than 100 kg of hazardous waste per month must send the hazardous waste to a permitted hazardous waste management facility. Generators producing less than 100 kg per month of hazardous waste (known as conditionally exempt small quantity generators, CESQGs) can dispose these materials in any state permitted solid waste management facility, including C&D debris landfills. The U.S. EPA does require operators of unlined landfills that accept CESQG hazardous waste to monitor the groundwater at the site (40 CFR 257).[60] Since many states either ban hazardous waste from landfill disposal (including CESQG hazardous waste) or exclude hazardous wastes as part of the definition of C&D debris, the relevance of the 257 regulations for C&D debris is limited. In an effort to streamline the removal of lead paint from residential housing, the U.S. EPA recently clarified that lead-based-paint debris removed from residential structures did qualify for the household waste exclusion under RCRA and thus was not a hazardous waste.[12]

Several other federal statutes and regulations may impact C&D debris management. Contractors renovating or demolishing buildings containing asbestos may be required to comply with the specific removal and disposal requirements found in the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations in 40 CFR 61. The asbestos NESHAP specifies proper containment for asbestos-containing waste and proper final cover requirements to prevent particulate matter from entering the air.[6] Since states determine the definition of C&D debris, a few states include asbestos waste within the definition of C&D debris. Many, however, forbid the disposal of asbestos-containing waste in C&D debris landfills. PCB ballasts from renovation and demolition debris are regulated under the Toxic Substances Control Act (TSCA) in 40 CFR Part 761.[7] Regulations regarding the disposal of lead-based paint debris were at one time proposed under TSCA,[11] but the rule never progressed beyond a proposal. Under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), also known as Superfund, C&D debris generators are strictly liable for any hazardous wastes that they dispose. Thus, even if not generating a hazardous waste under RCRA, generators and landfill operators could be held liable for future contamination from the management their C&D debris.

State Regulations Governing C&D Debris

Since the vast bulk of materials encountered in C&D debris does not contain asbestos and is not hazardous waste, management requirements for the majority of C&D debris produced in the United States are not covered by federal regulations. Most states have promulgated their own C&D debris management rules, including defining what waste materials are considered C&D debris and what components must be excluded. Requirements for groundwater monitoring, liner construction, site restrictions, financial assurance, training requirements, and recycling vary from state to state. These variations are primarily a result of the unique characteristics of each state and include variables such as annual rainfall, annual temperature range, land availability, and geologic stability, as well as perceptions by local policymakers and regulator as to the relative risk that C&D debris poses to human health and the environment. While the states have the freedom to create regulations to fit their unique situations, the lack of federal guidance has lead to inconsistent regulations throughout the nation.

METHODS

State solid waste regulations were reviewed and sections pertinent to C&D debris disposal were summarized into a one-page form submitted electronically to each state regulatory agency. Each appropriate state regulatory program was subsequently contacted via telephone or electronic mail for verification and comment on the program's requirements. These requirements were then interpreted by the authors and again submitted to state regulatory programs for final comment. The interpretations of the rules presented in the following sections are those of the authors, though state agencies were consulted for verification. Questions regarding more recent rule language or the interpretation of a rule should be directed to the appropriate state agency.

RESULTS

This state C&D debris regulation survey revealed a large diversity of requirements and approaches. This is illustrated in Table 1, which summarizes the state rules and requirements. Twenty-three states were found to have specific C&D debris disposal regulations (i.e., requirements for facilities that are separate and apart from MSW landfills). In other states, C&D debris is regulated under requirements for more general inert debris landfills, non-MSW landfills, MSW landfills, or general solid waste facilities. The detailed summaries of each state's C&D debris disposal requirements are provided in subsequent sections.

TABLE 1. Summary of State Requirements for C&D Debris Facilities

	Definitions					Liners				Permit issues				Other			
State	Construction and demolition debris/ waste	Const. debris/ waste	Demo. debris/ waste	Inert debris	Other definition (e.g. dry waste)	No liner reqmts	Conditional liner reqmts	Liner rqmts; no leachate collection	Liner reqmt with leachate collection	Financial assurance	Reqmt for operator training	Spotter req'd	Spotter training req'd	Regulation specifically for C&D debris landfills	Regulation covering C&D debris recycling facilities	State is updating rules on C&D debris	Groundwater monitoring
AL	X				X		X				X	X	X	X			
AK				X		X				X							X
AZ	X	X	X	X		X											
AR	X		X					X		X	X						
CA	X						X			X	X		X		X	X	X
CO	X			X	X				X	X						X	X
CT	X				X	X				X	X						X
DE					X				X	X							X
FL	X					X				X	X	X	X	X	X		X
GA	X			X		X				X	X			X	X		X
HI	X		X	X				X		X	X			X			X
ID				X		X									X		
IL	X					X			X[b]	X		X					
IN	X	X						X		X	X			X	X		
IA	X				X			X						X			X
KS	X				X	X				X	X			X		X	
KY	X	X							X	X	X	X	X	X			X
LA	X							X		X	X			X			
ME	X	X				X								X			
MD		X	X		X				X	X							X
MA	X								X	X					X	X	X
MI	X								X	X				X			X
MN			X		X	X					X		X			X	
MS					X		X								X		
MO					X				X	X	X[a]						X
MT	X						X					X					X
NE	X				X	X								X	X		
NV					X	X				X							X

NH	X				X				X	X	X	X		X	X		X
NJ	X								X	X	X				X		X
NM	X				X	X				X	X[a]			X			
NY	X			X	X				X	X				X	X		X
NC	X		X	X	X	X										X	
ND				X		X											
OH	X				X		X			X		X		X			
OK	X							X		X		X		X	X		X
OR	X						X			X							
PA	X	X							X	X		X		X	X		X
RI	X								MSW[c]	X					X		X
SC	X				X	X				X		X		X		X	
SD	X				X	X									X		
TN	X					X									X		
TX	X				X			X		X	X	X					X
UT	X			X		X				X							
VT	X					X				X					X		X
VA		X	X	X	X			X		X	X			X			X
WA			X	X					X	X	X	X			X	X	X
WV	X					X								X			
WI	X							X		X	X		X	X			X
WY	X					X					X			X			

[a]Certified operator must be present. Operator training is not specifically stated.
[b]Leachate monitoring is required. A liner system is not required.
[c]C&D debris falls under MSW category.

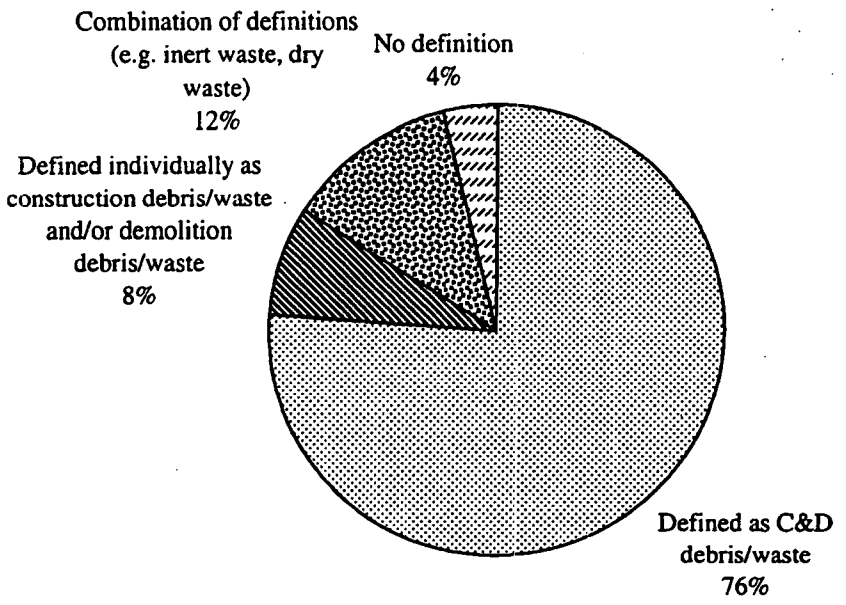


FIGURE 1. Summary of state C&D debris definition categories.

Definitions

The lack of a federal regulatory definition for C&D debris has resulted in each state defining C&D debris somewhat differently. The inclusion or exclusion of specific components within the C&D debris definition affects management of the waste. In addition, definitions are often included for waste streams that are in some way a part of or related to C&D debris, including dry waste, inert waste, land clearing debris, rubble, and rubbish. Figure 1 summarizes the range of definitions encountered. Most states (76%, 38 states) provide a definition for C&D debris or C&D waste. An additional four states instead individually define the terms construction debris/waste and/or demolition debris/waste, making forty-two states that specifically describe this waste stream. Some state definitions contain extreme detail regarding the source of C&D debris, their components, and prohibited materials. For example, Michigan defines *C&D debris* as:

> Waste building materials, packaging, and rubble that results from construction, remodeling, repair, and demolition operations on houses, commercial or industrial buildings, and other structures. Construction and demolition waste includes trees and stumps which are more than 4 ft in length and 2 inches in diam and which are removed from property during construction, maintenance, or repair. Construction and demolition waste does not include any of the following, even if it results from the construction, remodeling, repair, and demolition of structures: (i) Asbestos waste.

> (ii) Household waste. (iii) Corrugated containerboard. (iv) Appliances. (v) Drums and containers. (vi) Any aboveground or underground tank and associated piping, except septic tanks. (vii) Solid waste that results from any processing technique which renders individual waste components unrecognizable, such as pulverizing or shredding, unless the type and origin of such waste is known not to contain the wastes listed in paragraphs (i) to (vi) of this subdivision.[33]

Other states provide much more general descriptions; Montana defines *C&D debris* as:

> Waste building materials, packaging, and rubble resulting from construction, remodeling, repair, and demolition operations on pavements, houses, commercial buildings, and other structures, once municipal, household, commercial and industrial wastes have been removed.[37]

Outside of the definition of C&D debris/waste, some states choose to define construction and/or demolition waste separately. While six states define construction waste and eight states define demolition waste, only three of these states define both. Virginia, one of the three states that defines both, defines *construction waste* as:

> Solid waste which is produced or generated during construction, remodeling, or repair of pavements, houses, commercial buildings, and other structures. Construction wastes include, but are not limited to lumber, wire, sheetrock, broken brick, shingles, glass, pipes, concrete, paving materials, and metal and plastics if the metal or plastics are a part of the materials of construction or empty containers for such materials. Paints, coatings, solvents, asbestos, any liquid, compressed gases or semi-liquids and garbage are not construction wastes.[63]

while *demolition waste* is defined as:

> Solid waste which is produced by the destruction of structures and their foundations and includes the same materials as construction wastes.[63]

As C&D debris is often included in other waste categories, the lack of a specific definition for construction or demolition waste does not exclude the waste from another definition. Sixteen states include C&D debris in their definition of inert waste. Land-clearing debris can include C&D debris in six states. C&D debris is included within eight state definitions of rubbish and three state definitions of rubble. Some states such as Alaska define inert waste only and not C&D debris. Alaska defines *inert waste* as:

> Solid waste that has a low potential to pollute air or water, and that does not normally attract wildlife; includes coal power plant ash, scrap metal, auto fluff, construction and demolition waste, and pavement rubble; does not include asphalt material that contains asbestos.[2]

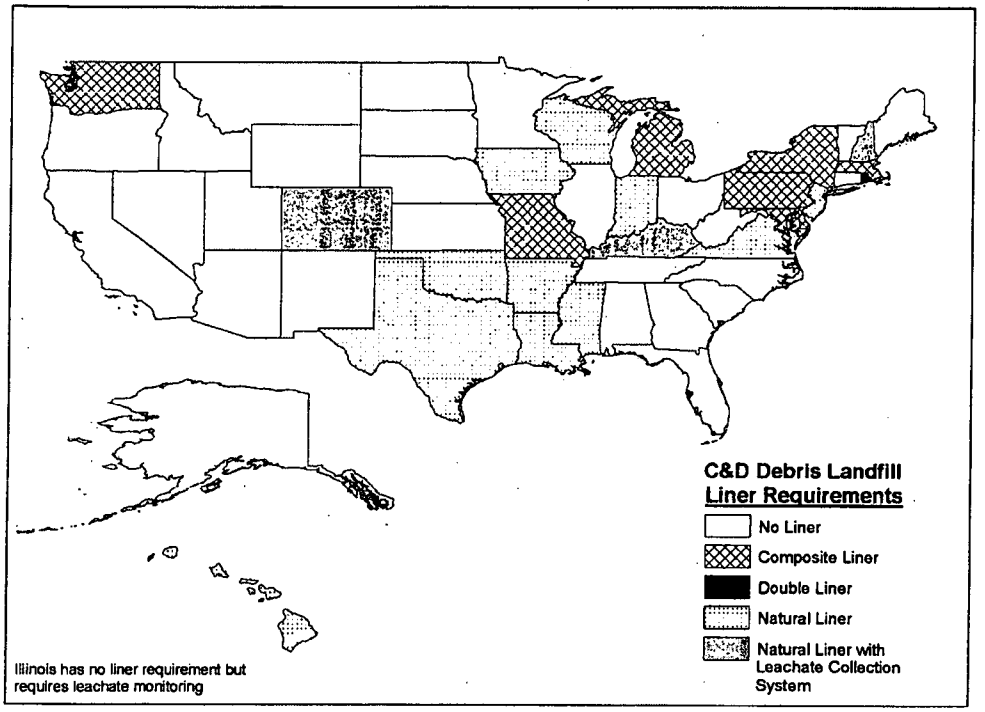
Other states define both C&D debris and inert waste. California, for example, defines *inert waste* as:

> Subset of solid waste that does not contain hazardous waste or soluble pollutants at concentrations in excess of applicable water quality objectives, and does not contain significant quantities of decomposable waste.[5]

As suggested by Alaska's and California's definitions, inert waste could potentially include most of the C&D debris stream, as well as other types of non-C&D debris materials. Land-clearing debris, on the other hand, is typically more narrowly defined.

Landfill Liner Requirements

Figure 2 summarizes state liner requirements by five categories: (1) those with no liner requirement, (2) those requiring natural soil liners but with



Note: Location or site-specific issues may result in more stringent requirements.

FIGURE 2. Minimum acceptable landfill liner requirements for C&D debris landfills.

no leachate collection system, (3) those requiring natural soil liners with leachate collection system, (4) those requiring composite liners, and (5) those requiring double liners. By limiting the materials that are defined as C&D debris, landfills that accept C&D debris in certain states including Connecticut and Idaho are not required to have liners. Of the states that require liners, the most common liner is a natural clay or soil liner of a specified thickness and permeability. States such as Louisiana, Arkansas, Iowa, and Oklahoma require natural liners. Additional requirements to the natural liner system may include a leachate collection system, as C&D debris landfills in Colorado must have. Some states requiring composite liners have regulations specifically for landfills handling C&D debris (e.g., Maryland), while some require composite liners because C&D debris falls under MSW regulations (e.g., Hawaii). The one state with a double liner requirement, Rhode Island, also manages C&D debris in MSW landfills.

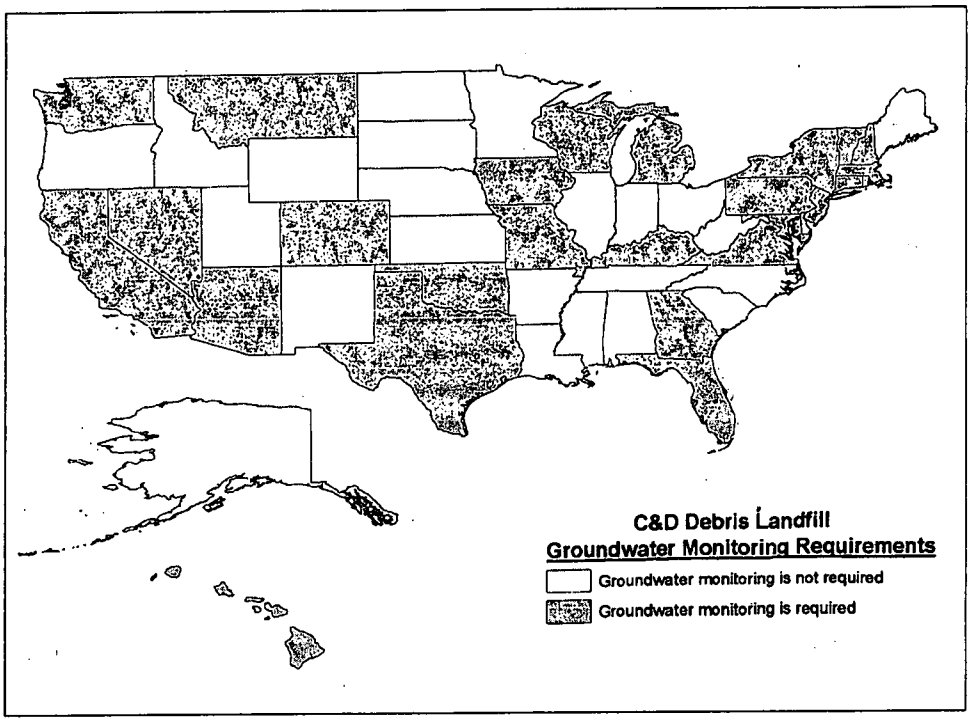
These categories reflect the minimum technology that a landfill accepting C&D debris must have in these states. In several states (e.g., Alabama, Oregon, New Jersey), more stringent requirements may be necessary depending on site-specific conditions (e.g., location, rainfall). If a landfill restricts the type of C&D debris accepted, some states may consider less stringent requirements (e.g., Kentucky). Twenty-seven states permit disposal of C&D debris into unlined landfills (excluding any prohibited materials mentioned within the regulations). The remaining 23 states have varying degrees of liners systems presented in Figure 2.

Monitoring

Figure 3 summarizes the state groundwater monitoring requirements. Twenty-seven states require groundwater monitoring. More detailed information regarding landfill requirements can be determined by comparing Figure 2 to Figure 3. Eight of the unlined landfill states require groundwater monitoring. The other 19 states do not require groundwater monitoring. Nineteen of the states that require liners also require groundwater monitoring while four states that require liners do not require groundwater monitoring.

Other Permit Issues

Financial assurance requirements are included for some states in the C&D debris section of the state regulations, while in other states they may be outlined in the general solid waste section, which covers C&D debris landfills (unless they are not specifically excluded). Those states with specific sections for C&D debris landfills may require financial assurance within the C&D debris landfill section, while specific details concerning procedures and assurance options are contained in a separate financial assurance section within



Note: Location or site-specific issues may result in more stringent requirements.

FIGURE 3. Minimum groundwater monitoring requirements for C&D debris landfills.

the greater solid waste management rules. Financial assurance requirements vary from requiring a specific amount per acre of the landfill to a minimum of operation and maintenance costs for a period after closure (e.g., 30 years).

Twenty-six states include specific personnel requirements. Twenty-one states require operator training. Most states require a plan to prevent hazardous wastes from being disposed at the facility, implying some type of waste screening should take place; only eleven states specifically require a spotter to identify unauthorized wastes. Six of the states requiring spotters include waste screening programs within their operator training.

C&D Debris Recycling

Because of the growing awareness that C&D debris is not as inert as once thought,[28,60,65] some states are revising their C&D debris regulations. States that provided current regulatory information but are in the process of developing new regulations include California, Kansas, North Carolina, Ohio, South Carolina, Washington, Colorado, and Massachusetts. The new rules will further regulate C&D debris landfills and C&D debris recycling practices and facilities. Increased regulation of C&D debris landfills can cause tipping fees to rise, thereby encouraging recycling. In other states (e.g., Florida),

recycling of C&D debris is encouraged by the nature of the local area. C&D landfills are scarce in South Florida because of lack of proper land to construct them, so recycling of C&D debris is a thriving industry. However, land is plentiful in North Florida, so C&D debris is mostly disposed in landfills there. Other states with small or limited land masses are trying to encourage C&D debris recycling with guidance and education (e.g., Hawaii) or with regulations (e.g., Massachusetts).

The primary alternative to landfill disposal of C&D debris is management at a recycling facility. C&D debris recycling facilities are large processing operations designed to separate materials from one another and to process the materials for subsequent reuse. In some cases, individual components are recovered for a variety of recycling markets. In other cases, combined materials are size-reduced for use as cover or fill materials at landfills. C&D debris processing facilities are much less uniformly regulated as compared to landfills. Seventeen states reported having processing facility requirements. This number may be larger because processing facilities may be covered under broader programs for such facilities. Some states, however, do have specific C&D debris processing or recycling facility regulatory requirements (e.g., Florida). These facilities have many of the same regulations as landfills, such as operator training and groundwater monitoring. It should be noted that even in those states where recycling facility regulations are in place, they usually only apply to facilities that accept mixed C&D debris as opposed to a single-stream debris (e.g., concrete or asphalt). Facilities that recycle only concrete or asphalt may not be regulated under solid waste regulations.

Several states have impending regulations that will impact C&D debris recycling. Massachusetts will ban concrete, asphalt, brick, wood and metal from landfill disposal in July 2006. California developed tiered regulations for recycling facilities requiring a mixed C&D debris recycling facility that accepts more than 160 metric tons (175 tons) per day (recycling at least 60% of that) to obtain a solid waste permit.

Detailed State C&D Debris Regulation Summaries

The information presented to this point summarizes the survey results and provides an overview of state C&D debris regulations. However, to fully understand the scope and variability of state C&D debris regulations, it is important to note the specific details of each state's C&D debris regulatory program. These details are presented as follows.

ALABAMA

Alabama defines *construction/demolition waste* and *rubbish*. Liner systems or groundwater monitoring are not required. Facilities are prohibited from

restricting water flow in floodplains, impacting endangered species, locating in geologically unstable areas, and impacting water quality in or near wetlands, beaches, or dunes. Training is required for the operator and spotter. Spotters are required to inspect all suspicious loads into the facility. Final cover consists of at least 15 cm (6 in) of earthen material capable of sustaining native vegetation (defined as the erosion layer), with a layer at least 46 cm (18 in) of compacted earthen material (that is not sand) underneath (defined as the infiltration layer).[1]

ALASKA

Alaska defines *inert waste* to include C&D debris. A liner system is not required for an inert waste landfill. Groundwater monitoring is not required at a landfill with a total volume less than 765 m^3 (1000 cubic yards) that only accepts inert waste and receives no more than 63.5 cm (25 in) in annual rainfall. If noninert waste is present or has been present at the site or evidence exists of a spill or groundwater contamination, then groundwater monitoring is required during the active life of the landfill. All other C&D debris facilities require groundwater monitoring. If groundwater monitoring is required during the active life of the landfill, it will also be required for postclosure. Even if it had not been required during the active life of the landfill, postclosure monitoring still may be required to ensure protection of the health and safety of the environment. If postclosure groundwater monitoring is required, then financial assurance must include the cost of postclosure monitoring. Otherwise, only the financial responsibility for closure is required. Any unlined landfill must be at least 3 m (10 ft) above the highest measured aquifer level or constructed 60 cm (2 ft) above the natural ground surface. Typically, landfills cannot be placed on permafrost unless no practical alternative exists. Operator training and spotters are not required for an inert waste landfill. Landfill operators must post a sign at the entrance stating that disposal of hazardous waste and PCB waste (polychlorinated biphenyls) is not permitted and notify regulators if improper waste is found at the facility. When closing the facility, a final soil cover at least 60 cm (24 in) thick is required.[2]

ARIZONA

Arizona has not yet established rules for C&D debris landfills. C&D debris is included within the definition for *Non-MSW*, but the state does not have guidelines for Non-MSW landfills. However, stringent state aquifer protection requirements require groundwater monitoring at all C&D debris landfills.[3]

ARKANSAS

Arkansas defines *construction and demolition debris* and *demolition debris*, both of which are typically disposed in Class 4 landfills (C&D landfills). A natural liner consisting of 46 cm (18 in) of compacted clay with a hydraulic

conductivity no greater 1×10^{-5} cm/sec is required. Leachate collection and groundwater monitoring are not required. Class 4 landfills may not be located in floodplains (if the landfill restricts flow or cannot prevent wash out of solid waste), wetlands, or geologically unstable areas. Landfills must have buffers from wells or water intakes used for drinking water, existing dwellings, and highways. Operator training is required. Although spotters are not required, a plan to exclude hazardous waste must be developed. The final cover must consist of 15 cm (6 in) of earthen material capable of sustaining plant growth (defined the erosion layer) and 46 cm (18 in) of clay soil barrier layer with hydraulic conductivity equal to the liner (defined as the infiltration layer). Financial assurance is required.[4]

CALIFORNIA

California defines *construction and demolition wastes*. C&D wastes are disposed in Class III landfills. A liner system is required when current site characteristics cannot ensure the protection of the quality of ground or surface water. In this case, Class III landfills must have a single clay liner with hydraulic conductivity of 1×10^{-6} cm/s or less. The clay liner should be a minimum of 30 cm (1 ft) thick and be installed with a relative compaction of at least 90%. Leachate collection is required at those facilities with a liner. Groundwater monitoring is required at all facilities. Facilities are prohibited from locating on a Holocene fault and must maintain a 1.5 m (5 ft) barrier between the lowest part of the waste disposal area and the highest ground water elevation. Operator training is required and includes identification and screening of hazardous materials. The final cover system consists of a foundation layer, a low-hydraulic-conductivity layer, and an erosion-resistance layer. The foundation layer should be at least 60 cm (2 ft) of soil or a similar material. The second layer should have a hydraulic conductivity of 1×10^{-6} cm/sec and consist of soil that is at least 1 ft thick. The erosion-resistant layer should be capable of sustaining plant growth requiring at least 1 ft of soil. Financial assurance is required.[5] California is currently creating regulations for C&D processing facilities.

COLORADO

Currently, C&D debris falls under standard solid waste rules. The Colorado Department of Public Health and Environment has reserved Section Four of the rules for C&D debris and inert debris disposal, but presently these wastes are disposed according to standard solid waste rules. Hence, either a natural liner or a composite liner is required. Two natural liner systems are allowed: (1) a barrier layer composed of soil or bedrock with a minimum thickness of 6.1 m (20 ft) with in situ hydraulic conductivity demonstrated to be less than or equal to 1×10^{-6} cm/sec and an upper layer of 30.5 cm (12 in) thick recompacted soil with a hydraulic conductivity no greater than 1×10^{-7} cm/sec, or (2) a soil liner at least 91 cm (3 ft) thick of compacted soil

with a hydraulic conductivity less than or equal to 1×10^{-7} cm/sec. Composite liner systems must have a lower natural component of at least 60 cm (2 ft) of compacted soil with a hydraulic conductivity less than or equal to 1×10^{-7} cm/sec and an upper flexible membrane liner (FML) at least 0.76 mm (30 mil) thick (1.5 mm [60 mil] if HDPE). A leachate collection system and groundwater monitoring are required. Landfills may not be located in wetlands, near a fault, in geologically unstable areas, in floodplains, or below or in surface water or groundwater. Operator training and spotters are not required.

Colorado requires either a soil final cover or a composite final cover. The soil final cover must have at least 46 cm (18 in) of earthen material with a permeability no more than the bottom liner system or 1×10^{-5} cm/sec, whichever is less (defined as the infiltration layer) and then a layer with a minimum 15 cm (6 in) of earthen material capable of sustaining native plant growth (defined as the erosion layer). The composite final cover has a foundation layer of at least 15 cm (6 in) of soil, which is immediately above the refuse. This forms a suitable foundation for the geomembrane barrier layer, which is no less than 0.76 mm (30 mil) thick and displays properties adequate for its intended purpose.

Financial assurance is required. Typically, financial assurance for C&D debris and inert debris landfills follow the 30-year maximum assurance required for MSW landfills, but the agency can shorten this requirement. Although Colorado has no specific rules for C&D debris landfills, the agency is currently working on recycling requirements for solid waste in general, which may affect the processing of C&D debris.[8]

CONNECTICUT

Connecticut defines *C&D waste* but has no liner requirements; however, according to the Connecticut Department of Environmental Protection (CDEP), the lack of regulatory requirements for a liner system allows regulatory flexibility. Currently, CDEP requires any new or horizontally expanded C&D debris landfill to have a liner system, and a groundwater discharge permit is required. Final cover at a C&D debris landfill consists of a minimum of 60 cm (2 ft) of low-permeability soil, and a few situations required a membrane cap. Connecticut requires operator training but does not require a spotter. Location requirements are not specified but are subject to regulatory siting criteria. Financial assurance is required for closure and post-closure maintenance costs. For new landfills, the state's solid waste management plan "recommends" that recycling opportunities should be considered and incorporated into the design and operation of a C&D landfill.[9]

DELAWARE

Delaware does not define C&D debris; however, according to Delaware's Regulations Governing Solid Waste (DRGSW), C&D debris is covered under

two categories, dry waste and industrial waste. The definition for *dry waste* includes the following:

> Plastics, rubber, lumber, trees, stumps, vegetative matter, asphalt pavement, asphaltic products incidental to construction/demolition debris, or other materials which have reduced potential for environmental degradation and leachate production.

The definition for *industrial waste* includes:

> Any water-borne liquid, gaseous, solid or other waste substance or a combination thereof resulting from any process of industry, manufacturing, trade or business, or from the development of any agricultural or natural resource.

Although C&D debris is not specifically defined, typical C&D debris components are included in the dry waste definition; and construction and demolition are considered a business in which industrial waste is produced; therefore, C&D debris would be disposed of in an industrial waste landfill.

A composite liner system is required for the landfills. The lower liner must be 60 cm (2 ft) thick compacted clay with a hydraulic conductivity of 1×10^{-7} cm/sec or less. The upper synthetic liner material should be at least 1.14 mm (45 mil) and made of materials that will not fail due to physical contact with leachate, weather conditions, or stresses from installation and use. Natural material liners may be constructed only in areas where the groundwater is not and will not be used for water supplies and where the subbase is subject to compaction and settlement such that a synthetic membrane would not be feasible. Leachate collection, treatment, disposal, and monitoring are required regardless of the type of liner system. Groundwater monitoring is required. Operator training and spotter training are not required by this regulation, but individual permits address the training requirements for employees.

Regulations prevent location within a 100-year floodplain; wetlands; 1 mile of state or federal wildlife refuge, wildlife area, or park; wellhead protection areas where valuable aquifers would be threatened; 200 ft of a facility boundary; or areas that are environmentally unique or valuable. Each landfill must observe any locally adopted land use plan or zoning requirements. The capping system must be constructed of a final grade layer of soil at least 6 inches thick, an impermeable layer of either a 0.76-mm (30-mil) geomembrane over a geotextile or 61 cm (24 in) of clay with a hydraulic conductivity less than 1×10^{-7} cm/sec, and a final cover of 46 cm (18 in) of soil and 15 cm (6 in) of topsoil or other approved alternative. Financial assurance is required.[10]

FLORIDA

Florida defines *construction and demolition debris*, which is typically disposed in C&D debris landfills. Liners and leachate collection systems are not required; however, based on the types of waste received, methods for controlling the types of waste disposed, the proximity of groundwater and surface water, and the results of the hydrogeological and geotechnical investigations indicating that operation of the facility is reasonably expected to result in violations of groundwater standards and criteria, the Florida Department of Environmental Protection (DEP) can require a liner before a permit is granted. Groundwater monitoring is required on a semiannual basis. If the facility is within 60 m (200 ft) of a water body, surface water sampling may be required.

An operation and a closure plan are required. Spotters are required at the working face to inspect incoming waste at all times. Operators and spotters must be properly trained, and a training plan must be included in the permit application. Operators must have 20 hours of training in the first year and 15 hours continuing training in each subsequent three-year period. Spotters require training at the same frequency, but only 8 hours initially and 8 hours continuing.

Final cover must be placed within 180 days of reaching final grade. The final cover must consist of a 60 cm (24 in) thick soil layer, the upper 15 cm (6 in) of which shall be capable of supporting vegetation and graded and compacted as necessary to eliminate ponding, promote drainage, and minimize erosion. Florida has C&D debris material recover facility (MRF) regulations; the requirements are similar to the landfill regulations, including groundwater monitoring, spotter requirements, training requirements, and financial insurance. To encourage recycling of C&D debris, Florida requires segregated disposal of C&D debris at MSW landfills (usually by employing two working faces). Residuals from C&D debris processing facilities can be directly landfilled.[13]

GEORGIA

Georgia defines *construction and demolition waste* and *inert waste*. Inert waste may be disposed in a C&D landfill, but C&D debris may not be disposed in an inert landfill. *Inert* is defined as stumps, brush, limbs, leaves, broken concrete, broken asphalt, dirt, rocks, and dirt-like products. A liner is not required for C&D landfills; however, groundwater and methane gas monitoring is required. Rules specify operator training but do not require a spotter. Minimum distances are required from fault areas, unstable areas unless the facility is designed to withstand dangers, significant groundwater recharge areas, private water supply wells, and surface water. Facilities located in a floodplain should not restrict water flow. Facilities should not be located in wetlands or over seismic impact zones. Percolation into final

cover should be minimized. Vegetation should be in place within two weeks after final cover placement. Financial assurance is required. Facilities that shred, bale, or recover materials or engage in other processing operations must have a properly trained operator on duty at all times during operation. These facilities must also have a designated C&D debris unloading (tipping) area, and adhere to any air quality requirements.[16]

HAWAII

Because of Hawaii's small land mass and population, typically no more than one landfill (an MSW landfill) exists per island. Two C&D debris landfills exist in Hawaii: one is on Oahu, and the other on Maui.[16] The majority of the C&D debris waste generated on Hawaii, Kauai, Molokai, and Lanai goes to MSW landfills, with a smaller portion being recycled. The solid waste rules define *construction and demolition waste, demolition waste*, and *inert waste*. Both C&D landfills and MSW landfills are regulated by the Hawaii Department of Health (DOH), and most C&D debris in Hawaii is disposed in C&D landfills.

MSW landfills must meet federal Subtitle D landfill requirements (40 CFR 258). C&D debris landfills are required to obtain a solid waste management permit and meet requirements specified in the permit. C&D debris landfills must include a leachate management plan that requires a soil liner at least 60 cm (2 ft) thick with a maximum permeability of 1×10^{-5} cm/sec or an alternative dependent on the hydrogeological condition of the area.

Groundwater monitoring is required at both disposal facilities unless otherwise stated by the DOH. Location restrictions include prohibition from areas susceptible to flooding; in wetlands (except under certain conditions); near potable water supplies; near airports; near fault areas, seismic impact zones, or in any other unstable locations; and near tidal wave zones.

Neither MSW landfills nor C&D debris landfills may accept hazardous wastes or PCB wastes. Personnel should be trained to recognize hazardous wastes and PCB wastes. C&D debris landfills must adhere to operation procedures specified in the operation plan included in the permit application. Spotters are not required by the regulations but are required in the facility's operations manual, which, upon approval by the state, becomes part of the landfill's permit.

Final cover systems should be designed to minimize erosion and infiltration. The system for an MSW landfill should have a permeability less than or equal to the permeability of the bottom liner system or natural subsoils or no greater that 1×10^{-5} cm/sec. The layer to minimize infiltration should be made of earthen material and be at least 46 cm (18 in) thick. The layer to minimize erosion should be a minimum of 15 cm (6 in) thick of soil capable of sustaining native plant growth. The Department may approve an alternative final cover design. Financial assurance is required to cover closure, postclosure, and corrective action at both MSW and C&D debris landfill facilities.[18] Because of Hawaii's unique situation (islands and landmass) and the fact that

C&D debris is generally sent to landfills in Hawaii, a newly written guide, entitled *Minimizing Construction and Demolition Waste 3rd Edition*, assists in the development of recycling operations in the state.[19]

IDAHO

Idaho does not define C&D debris. Instead, waste is disposed in a facility according to its characterization. C&D debris composed of blocks, bricks, cement, and concrete is classified as *inert waste* and is exempt from solid waste regulation. This debris is often sent to rock quarries to be reclaimed, depending on individual county requirements. Other C&D debris composed of wood waste and gypsum drywall is regulated under solid waste rules. This waste is generally sent to a landfill (Tier II facility) for disposal. Large quantities of gypsum drywall might be sent to a Tier III facility, which follows MSW landfill rules with requirements similar to MSW landfill requirements. The types of waste generated at a C&D site determines the regulations that must be applied. For this paper, Tier II facility requirements will be reviewed, as the majority of C&D debris is disposed at such a facility.

Tier II facilities are not required to have liners or groundwater monitoring systems. Facilities are prohibited from contributing to the destruction of the critical habitat of endangered or threatened species; contaminating surface waters unless such waters are an integral part of the facility's operation for stormwater or leachate management; contaminating drinking water or groundwater, and locating in a 100-year floodplain, within 305 m (1000 ft) of any state or national park, wetlands, and geologically unstable areas. The active portion of facility may not be within 30.5 m (100 ft) of the property line. Operating training is not required. A spotter is not required, although the facility must have an approved method for identifying and handling unauthorized waste. Final cover consists of 46 cm (18 in) of compacted soil to minimize infiltration and a soil layer of 15 cm (6 in) to minimize erosion and sustain plant growth.[20]

ILLINOIS

Illinois defines *construction or demolition debris*, which is typically disposed at an inert waste landfill facility. Liners are not required, but leachate collection and monitoring are. All inert waste landfills shall be designed to include monitoring systems capable of collecting representative samples of leachate generated by the waste, using methods such as but not limited to a pressure-vacuum lysimeter, trench lysimeter, or a well point. Sampling locations shall be properly located to collect the least diluted leachate samples. Samples must be collected every 6 months and characterized for a suite of chemical parameters that provide indicators of contamination (organic chemical need to be analyzed every 2 years). If an inert waste landfill causes contamination or organics are detected in the leachate, the following will occur: (1) The facility will no longer be subject to inert waste landfill requirements of

Subpart B, and (2) the facility will be subject to requirements for Putrescible and Chemical Waste Landfills of Subpart C, including closure and remedial action.

Operators accept wastes for disposal only when accompanied by documentation that the wastes are inert based on testing of the leaching properties of the waste. Operators must conduct random load checking. Facility location should meet requirements under the Wild and Scenic Rivers Act and Clean Water Act. Location should not restrict flow in 100-year floodplain, adversely affect endangered species or critical habitat for such species, or violate requirements for area wide or statewide water quality management plan for nonpoint source pollution. Financial assurance is required.[21]

INDIANA

Indiana defines *construction/demolition waste* and *construction waste*. For C&D landfills, a soil barrier at least 60 cm (3 ft) thick with a hydraulic conductivity no greater than 1×10^{-6} cm/sec must separate the waste from a locally useful aquifer. If not, a synthetic liner may be required. Groundwater monitoring is not required because CESQG hazardous waste is not allowed to be disposed in the C&D landfill. Location restrictions include prohibitions from wetlands, critical habitats, floodways, karst, and over mines. Minimum distance requirements for waste disposal include 183 m (600 ft) from potable well or dwelling, 30.5 m (100 ft) from normal waterline within a floodplain, and 15.3 m (50 ft) from the property boundary. Operator certification is required. Final cover must be 60 cm (2 ft) thick within 180 days of closing. Financial assurance is required. Waste sent to recycling facilities is considered segregated waste unless 10% or more of the waste eventually goes to disposal; then the facility is classified as a transfer station.[22]

IOWA

Iowa defines *C&D debris, rubble*, and *rubbish*. A natural liner is required for non-MSW landfills. The liner must consist of at least four ft of recompacted soil with in-place permeability no greater than 1×10^{-7} cm/sec once in place. Groundwater monitoring is required. Location requirements are based on local siting and zoning specifications as well as general geologic and hydrogeologic criteria. Operator training is not required; however, spotters are recommended. The upper layer of final cover for the nonmunicipal landfill must consist of at least 60 cm (2 ft) of uncompacted soil with enough organic matter to support vegetation. The depth of this soil layer must be sufficient to prevent root penetration by planned vegetative cover into underlying soil layers. The lower layer of the cover must be at least 60 cm (2 ft) of compacted soil with permeability of 1×10^{-7} cm/sec or less. Compacted soil, incinerator ash, or similar material permitted by the Iowa Department of Natural Resources may be used to prepare the site for placement of this compacted soil layer, however, such material will not replace the compacted soil

layer. Financial assurance is not required. Although recycling is not required, a plan for waste reduction goals must be in place.[23]

KANSAS

Kansas defines *C&D debris* and *rubble* to include C&D debris. No liner system or groundwater monitoring is required for C&D landfills. Kansas is currently drafting new C&D regulations with new requirements, but not for a liner system or groundwater monitoring. An operating plan and operator training are required. Spotters are not required, but waste must be screened to ensure that only C&D waste is received. The final cover must be a minimum of 46 cm (18 in), including 30.5 cm (12 in) of compacted soil and 15 cm (6 in) of a vegetative layer. The current rules require a C&D landfill to be at least 0.8 km (0.5 mi) from a navigable stream. The new rules will have more comprehensive location restrictions. Financial assurance is required for closure and postclosure care.[25]

KENTUCKY

Kentucky defines *construction/demolition waste, construction materials*, and *construction/demolition debris landfill*. In addition to accepting C&D debris, a C&D debris landfill can accept other uncontaminated solid waste materials including metals, furniture, and paper. A C&D debris landfill is required to have a natural liner and leachate collection system. The natural liner must be at least 15 cm (12 in) thick soil with an additional soil component at least 15 cm (12 in) thick with permeability no greater than 1×10^{-7} cm/sec. This must be overlain by a 15 cm (12 in) drainage layer with a minimum permeability of 1×10^{-3} cm/sec. For C&D debris landfill facilities that exclude waste materials other than C&D debris, nonputrescible wastes, and wastes that do not leach or exceed environmental performance standards, the liner requirements are reduced to a minimum of 60 cm (2 ft) of recompacted soil without a permeability requirement, a drainage layer, or a leachate collection system.

Groundwater monitoring is required. Operator training is required and includes training for spotters. Facilities must maintain a minimum distance between waste disposal site and perennial streams; collapse zones of deep-mines or critical angles of draws; karst terrain features; property lines; residences; utility lines including gas, sewer, and water lines; unplugged wells except monitoring wells; airports; and fault areas. The liner bottom should maintain 1.23 m (4 ft) buffer above the seasonal high groundwater table. Facilities are prohibited in floodplains and unstable areas.

Final cover requirements for C&D debris landfills include grading to achieve a final slope between 5 and 25%, cover layer 15 cm (12 in) thick, and 30.5 cm (12 in) cap over cover layer with a maximum permeability of 1×10^{-7} cm/sec. The cap should be covered by a drainage layer 15 cm (6 in) thick with permeability of 1×10^{-3} cm/sec on slopes less than 15%. A system of drainage tiles should be in place to relieve water collected by the drainage

layer. An overlying filter fabric or other material shall cover the drainage layer, and a minimum of 91 cm (3 ft) of vegetative soil should cover the filter fabric. If the facility is limited to C&D debris, nonputrescible wastes, and wastes that do not leach or exceed environmental performance standards, the final cover need only be a minimum of 91 cm (3 ft) of vegetative soil. Financial assurance is required.[26]

LOUISIANA

Louisiana defines *C&D debris*, which is disposed in Type III landfills. A base layer of 60 cm (2 ft) of recompacted clay with 1×10^{-7} cm/sec permeability is required for the Type III landfill. Groundwater monitoring is not required. Geology determines location requirements; in addition, no standing water is allowed on site. Operator training is required and includes 10 hours annually with 40 hours every 4 years for recertification. Spotters may be required based upon the size and type of materials accepted at the landfill. Only noncontaminated materials are allowed on site, and landfills are inspected at least four times per year by the Louisiana Department of Environmental Quality (LDEQ). Final cover must consist of 60 cm (2 ft) of recompacted clay with 15 cm (6 in) of topsoil for vegetative cover.[29]

MAINE

Maine defines *construction, demolition*, and *construction and demolition debris*. *Inert fill* and *land clearing debris* (which do not include C&D debris) are defined and may be disposed within a C&D landfill. Neither a liner system nor groundwater monitoring is required; however, if natural in situ soils cannot accommodate all leachate production, then a leachate management system may be required. Operator training is voluntary, but spotters are required. A landfill may not be on undisturbed soil less than 1.5 m (5 ft) thick, undisturbed soil less than 91 cm (3 ft) above the seasonal high water table, 100-year floodplain, an unstable area, a coastal sand dune system, a coastal wetland, or a fragile mountain area. Minimum distances are required from the aquifer, public roads, property boundaries, nearest residence, stratified sand and gravel deposits, classified surface waters, water supply springs, and water supply wells. The landfill may not be located near a significant wildlife habitat or cover more than 2.4 ha (6 acres). The operating life is limited to 20 years, and final cover must consist of 46 cm (18 in) of clay covered by 15 cm (6 in) of soil suitable for vegetative growth. Financial assurance is not required. A waste management plan that minimizes landfilling of wastes and maximizes recycling must be in effect.[30]

MARYLAND

In addition to defining *construction, demolition*, and *land clearing debris*, Maryland defines *processed debris* to include C&D debris. A liner system consisting of both natural and synthetic materials is required. The natural component is composed of at least 30.5 cm (1 ft) of clay or other natural

material with in-place permeability no greater 1×10^{-7} cm/sec. The natural component can be substituted with (1) one or more unreinforced synthetic membranes with a combined thickness of at least 1.27 mm (50 mil) or (2) a single reinforced synthetic membrane with thickness at least 0.76 mm (30 mil) with a permeability less than or equal to 1×10^{-10} cm/sec. The synthetic liner must be installed over a 60 cm (2 ft) subbase, be free of objects that could damage the liner, and have a permeability no greater than 1×10^{-5} cm/sec. Groundwater monitoring is required at least semiannually. Operator training must be adequate to operate the site in accordance with the permit; spotters are not required.

Proposed landfill locations are evaluated by various state agencies as part of the review process described in the solid waste regulations. Final cover must consist of 60 cm (2 ft) of dirt placed within 30 days of closure, with a final cap constructed within 2 years. Financial assurance is required.[31]

MASSACHUSETTS

Massachusetts defines both construction and demolition waste and solid waste to include C&D debris. The regulations require a double composite liner system beneath landfills constructed with slopes of less than four horizontal to one vertical (<4:1). Other liner requirements are specific to slopes greater than 4:1. The double composite liner is constructed of a primary composite liner consisting of 30.5 cm (12 in) of a low permeability compacted soil layer/admixture (a hydraulic conductivity of 1×10^{-7} cm/sec) or a geosynthetic clay liner (GCL) overlain by a flexible membrane liner (FML), a leak detection and secondary collection system located between the primary and secondary liner, a secondary composite liner consisting of 60 cm (2 ft) of a low permeability compacted soil layer/admixture (a hydraulic conductivity of 1×10^{-7} cm/sec) or 30.5 cm (12 in) of a low permeability compacted soil layer overlain by a geosynthetic clay liner (GCL) and a flexible membrane liner (FML). Liner requirements may be less where MSW ash, C&D waste or other single source waste types are being disposed and characteristics of the waste such as permeability, leachate quality or other characteristics of the waste are considered. A leachate collection system and a storage system are required unless the collection system is directly connected to the sewer system. Groundwater monitoring is required. No operator training or spotters are required.

The location requirements include preventing location near public water supply wells or protection areas or where discharge from the facility could pose a danger to drinking water source areas. Waste may not be placed over the recharge area of a sole source aquifer unless no wells or water supplies or proposed wells or water supplies are downgradient of the site. Facilities are not permitted within areas where maximum high groundwater table is within 122 cm (4 ft) of ground surface or where a liner is designed to the satisfaction of the Massachusetts DEP, 122 cm (4 ft) of the bottom of the lowermost liner; wetlands; 100-year floodplains; areas where leachate discharge

would adversely impact groundwater; agricultural lands; areas where traffic impacts facility operation and constitutes a danger to public health and safety or the environment; areas where waste deposition would negatively impact endangered, threatened, or special concern species; ecologically significant natural community and state wildlife management area; state forests; and state or municipal parklands or conservation lands.

No site will be suitable if the anticipated emissions would not meet required state and federal air quality standards or constitute a danger to public health and safety or the environment. Minimum distance requirements include 30.5 m (100 ft) from waste handling area and property boundary; 305 m (1000 ft) from any occupied residence, health care facility, prison, school, licensed day care center, senior center, or youth center; 122 m (400 ft) from a lake; and 61 m (200 ft) from a riverfront area. Final cover should consist of a subgrade layer, gas venting layer, low permeability layer, drainage layer, filter layer, vegetative support or protection layer, and vegetative cover. Financial assurance is required.

While asphalt pavement, brick, and concrete recycling operations do not require permits if located at the site of C&D debris generation or at a quarry, facilities processing other debris components need a permit. Massachusetts requires a facility to recycle or compost 25% by weight of the average yearly amount of waste the facility may accept for disposal. This requirement may be met by any combination of the following activities: (1) The facility provides recycling or composting, (2) waste destined for recycling or composting is sent to a processor at a different site, (3) waste is diverted by the generator or intermediate handler to a recycling or composting facility prior to the waste being delivered to the landfill, or (4) the operator provides the opportunity to recycle or compost. The 25% may be reduced, deferred, or suspended if the operator cannot feasibly meet the requirement. The DEP may consider the following when deciding whether to adjust the requirement: (1) the effect of the requirement on existing waste disposal contracts, (2) the financial obligations of the operator, (3) the implementation costs at municipally owned facilities, and (4) the availability of nondisposal alternatives. The DEP also may limit the percentage of recyclable material that non-postconsumer recyclables assume.[32]

MICHIGAN

Michigan defines *construction and demolition waste.* A composite liner system is required. The lower component should consist of either compacted soil at least 60 cm (2 ft) thick or a bentonite geocomposite liner. The upper component should consist of at least a 0.76 mm (30 mil) thick FML installed in direct contact with the lower component. If HDPE is used, the minimum thickness required is 1.5 mm (60 mil). Leachate collection and groundwater monitoring are required. If the groundwater cannot be monitored, the landfill must have a leak detection system that is monitored. Operator training is not required.

Location restrictions include minimum distances from property boundary, environmentally sensitive areas, minimum distance from airports, floodplains, wetlands, fault areas and seismic impact zones, and unstable areas. Final cover should consist of a layer to minimize infiltration underneath a layer to minimize erosion. The layer to minimize infiltration must have 60 cm (2 ft) of soil either compacted or in conjunction with a FML. The minimum thickness for the layer to prevent erosion is 15 cm (6 in) of earthen material capable of supporting native plant growth. Financial assurance is required and is currently $20,000 per acre. Recycling facility requirements are covered under other permitting requirements.[33]

MINNESOTA

Minnesota defines *demolition debris* and *rubbish*. Liner systems are not required for demolition landfills. Although the waste materials approved for disposal in a demolition landfill vary depending upon the specific facility permit conditions, demolition landfills in Minnesota typically accept construction waste that is similar to demolition waste. Groundwater monitoring is conditional. The Minnesota Pollution Control Agency (MPCA) can require monitoring because of various criteria, including the type of waste accepted, site location and hydrogeology, length of operating life, size of facility, and potential for harm to human health or the environment. Operator training and certification are required. Although spotters are not required, a significant component of the operator training and certification involves identifying and spotting prohibited waste.

Minnesota has general landfill location standards and specific location standards for demolition landfills. General restrictions for new landfills prohibit location within floodplains, shoreland, river land if wild and scenic, wetlands, or areas where emissions of air pollutants would violate air quality standards. Specific location restrictions for demolition landfills prohibit location at a karst site or where the topography, geology, or soil cannot adequately protect ground or surface water. Final cover should prevent erosion of surface and side slopes, minimize particulate matter, and maintain vegetative growth. Financial assurance is not required unless the MPCA determines that financial assurance is necessary for the proper operation, closure, postclosure care, and corrective action because of size, site hydrogeology, operating life, or types of waste accepted.[34]

MISSISSIPPI

C&D debris is not specifically defined in the regulations. *Rubbish* and *industrial process debris* both include C&D debris, which is typically sent to a Class I Rubbish Site. A natural liner is required and may consist of naturally occurring low-permeability soil at least 1.53 m (5 ft) thick below the waste and 91 cm (3 ft) laterally from the waste. A buffer between the liner and the uppermost aquifer must be 1.53 m (5 ft) thick. Where a site cannot meet the natural liner requirements, an alternative constructed liner system may

be proposed. Groundwater monitoring is required under some site conditions. Operator training is not required. Although a spotter is not required, unauthorized waste must be identified and removed from waste loads.

Minimum distances are required from airports; public wells and public water supply surface water intakes; surface water bodies such as river, lake, or coastal water; parks and recreational areas; forests and wilderness area; wildlife management and natural areas; schools, hospitals, and other similar structures; and residences, roads, and highways. A buffer of 152 m (500 ft) from property boundary line or 76.2 m (250 ft) with adequate screening is required. Landfills are prohibited from locations where water flow in floodplains and from wetlands, locations above hydrocarbon wells and water wells water, locations that will affect endangered or threatened species, and historical and archaeological areas may be affected. Final cover should be 60 cm (2 ft) of earthen material in place within thirty days of completion of site activities. For sites that propose to collect and recycle C&D debris, a solid waste permit may not be required if only recyclable, inert rubbish wastes are collected. If collected wastes containing both recyclable and nonrecyclable materials are processed at a recycling facility, then a permit is required.[35]

MISSOURI

Missouri regulations define *demolition* landfills. A liner system composed of natural and synthetic components is required. The lower layer must be at least 60 cm (2 ft) thick compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. The upper component should be at least a 0.76 mm (30 mil) thick geomembrane (1.5 mm (60 mil) thick if HDPE). The upper component must be in direct and uniform contact with the compacted soil to minimize migration of leachate should a leak occur. Leachate collection and groundwater monitoring are required. The landfill must have a certified solid waste technician overseeing operations, but a spotter is not required. A landfill may not be located in a 100-year floodplain, seismically unstable locations, or wetland areas without demonstrating that the facility would not impact these areas. A final cover consisting of 15 cm (1 ft) of compacted clay, a geomembrane with permeability less than or equal to the liner membrane, and 60 cm (2 ft) of soil for a vegetative layer are required. Financial assurance is required.[36]

MONTANA

Montana defines *construction waste*, which is typically disposed in a Class IV landfill. A liner is not required for Class IV landfill if located within the groundwater monitoring network of a Class II (MSW) landfill. Liner requirements for Class IV landfills are dependent on site location and characteristics; however, groundwater monitoring is required. No restrictions other than the location determine the need for a liner. Spotters are required, but not operator training. Final cover consists of a layer to minimize infiltration, a layer to minimize erosion, and native plant vegetation. The layer to minimize infiltration

must contain a minimum of 46 cm (18 in) of earthen material with permeability no greater than 1×10^{-5} cm/sec. The layer to minimize erosion should be at least 15 cm (6 in) of earthen material capable of sustaining native plant growth. Financial assurance is not required.[37]

NEBRASKA

Nebraska defines *construction and demolition waste.* Nebraska has no requirements for a liner. Groundwater monitoring is conditional and can be required under certain site conditions. Operator training is not required, however unauthorized waste must be identified and removed. A 3 m (10 ft) vertical barrier must be maintained between the lowest point of the lowest waste cell and the maximum predicted water table elevation. The facility may not be located in a 100-year floodplain, wetlands, or unstable areas. Final cover for the landfill includes 91 cm (3 ft) of earthen material capable of sustaining vegetation. Final grades and side slopes of the closed area shall prevent erosion of the final cover. Operation, closure, and postclosure plans are required. Financial assurance is required for closure activities and for post-closure maintenance.[38]

NEVADA

Nevada defines *rubbish* and *industrial solid waste* to include C&D waste. A liner is not required if only these wastes are accepted, but the design of the landfill must sufficiently protect waters. Groundwater monitoring is required, although with a demonstration of no migration the requirement can be waived. Operator training and spotters are not required; however, a facility must have an approved waste-screening program. Both final cover and financial assurance are required for closure.[39]

NEW HAMPSHIRE

New Hampshire defines *construction and demolition debris* and *inert construction and demolition debris.* Materials that do not degrade or generate leachate are classified as inert and may be disposed in an unlined landfill. Unlined landfills must have groundwater monitoring, stormwater management, and a final cover system that is less stringent than those at lined facilities. All other C&D debris is sent to a C&D debris landfill, which requires a single liner system if the characteristics of the wastes are determined to not pose a threat to groundwater quality; otherwise a double liner system must be in place.

The single liner system is composed of the following components: a liner, a leachate collection and removal system, and a leak detection/location system. The liner may consist of either natural of synthetic materials. Natural liners should be at least 91 cm (3 ft) of recompacted natural soil with a hydraulic conductivity no greater than 1×10^{-7} cm/sec. Geomembrane liners should be at least 1.5 mm (60 mil) thick. Groundwater monitoring is required regardless of the liner system. Other requirements include operator training and spotters to inspect incoming waste.

Facilities may only be located where groundwater can be monitored prior to a release that may adversely impact the water supply. Minimum distances are required from perennial surface water bodies, wetlands, surface water reservoirs, roads and highways, airports, and faults. Facilities may not be located near shorelands or designated rivers. The bottom liner must be at least 1.83 m (6 ft) above the seasonal high groundwater table, and the waste must be deposited at least 30.5 m (100 ft) from the property line.

The final capping system for the landfill involves several layers. Fifteen cm (6 in) of unspecified soil that resists raveling or sifting should immediately overlay the waste. Above this layer is a protective layer of 30.5 cm (12 in) of sand. If a facility has an active gas extraction system, this layer need only be 15 cm (6 in) thick. A methane gas management system consisting of an impermeable barrier of either a geomembrane 1.02 mm (40 mil) thick or impermeable soils to minimize the infiltration of water into underlying wastes. The next layer should divert water that infiltrates the topsoil layer, be at least 46 cm (18 in) of free-draining sand with a saturated hydraulic conductivity no less than 1×10^{-3} cm/sec, and protect the middle layer from protrusion. The final layer should stabilize the capping system against erosion, promote evapotranspiration, and plant transpiration. This top layer should be at least 10.2 cm (4 in) thick, composed of topsoil, and fertilized and vegetated. Closure requirements include financial assurance.

New Hampshire also includes requirements for recycling facilities, including areas for waste receiving and inspection, waste sorting (if the facility sorts waste), hot load segregation and control, and waste storage. Stored waste managed as a recyclable material should be contained in a manner that preserves its market value. Recycling facilities should (1) provide access to all waste piles for fire control purposes, (2) limit stockpiles to heights compatible with local fire fighting equipment, and (3) provide a water supply that meets distance and quantity requirements of local fire fighting needs. All processed recyclable materials must be removed to an authorized facility prior to facility closure.[40]

NEW JERSEY

Most New Jersey landfills have double composite liner systems, but a Class III landfill has fewer requirements. Class III landfills accept inert, bulky, and vegetative wastes. New Jersey has a high rate of recycling C&D debris, but those wastes that are not recycled are generally disposed in a Class III landfill. For a landfill located in stable, low-permeability soil with a hydraulic conductivity of less than 1×10^{-6} cm/sec, the liner system must include at least 91 cm (3 ft) of clay or soil admixture with a hydraulic conductivity equal to or less than 1×10^{-7} cm/sec and a leachate collection system consisting of 30 cm (1 ft) of sand drainage layer with a hydraulic conductivity equal to or greater than 1×10^{-2} cm/sec.

If the location does not meet the low permeability soil requirement, a composite liner system must be constructed at a minimum consisting of a geomembrane liner over a 60 cm (2 ft) layer of compacted clay or admixture liner with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. A landfill located in a geologic area with bedrock at or near the surface and serving as a direct source for a public community water system must have a double composite liner system. The primary and secondary geomembrane liners in the double composite liner system must be above a clay or admixture liner. A leak detection/secondary collection system must be located between the primary composite liner and the secondary composite liner. Groundwater monitoring and financial assurance are required.

Location requirements include protecting environmentally sensitive areas like flood fringe areas; wetland buffer areas; lands dedicated to agriculture or in farmland preservation programs; watershed areas for high-quality streams; lands near any lake, pond, river, or stream; and the designated pinelands protection area. Landfills must be designed to protect areas above cavernous limestone, dolomite, or marble or over subsurface mining activities; within 4.83 km (3 miles) from nearest runway; encroaching upon objects included in the Register of Historic Places; within buffer zone area of specimen trees as determined by the Division of Parks and Forestry, and with slopes exceeding 15%.

Each operator should receive initial training within 6 months of beginning work and annual training. The training program is described in detail in the regulations and should be directed by a person thoroughly familiar with the facility technology and permit conditions.

Final cover for the Class III sanitary landfill must consist of 60 cm (2 ft) of natural material with a permeability less than or equal to the bottom liner system or natural subsoils present, or 1×10^{-5} cm/sec, whichever is less. The cover depth must be at least 18 inches and overlain by at least 15.3 cm (6 in) of soil as a layer to minimize erosion. If a synthetic membrane is used in the bottom liner system, then the final cover must also include a synthetic membrane. Upon approval from the New Jersey Department of Environmental Protection (NJ DEP), an alternative cover scheme may be used. Financial assurance is required.[41]

At Class B recycling facilities (may be C&D debris), a 7.6 m (25 ft) buffer zone is required around the facility property. The recycling facility is also required to provide (to the NJ DEP) end market information for types and volumes of material recycled.[42]

NEW MEXICO

The New Mexico Environment Department defines *construction and demolition debris*. C&D debris includes *land clearing debris*; *clean fill* is composed of material from C&D activities. A liner system and groundwater monitoring

are not required if a landfill receives less than 22.7 metric tons (25 tons) per day. If the landfill receives more than that, it is classified as a municipal landfill and is regulated as such. A certified operator must be present during operations, but a spotter is not required. C&D landfills are prohibited in certain areas as specified in 20:9.1:303 of the New Mexico Administrative code and include location restrictions in natural, potable, historical, and archaeologically significant areas. Final cover must consist of a minimum of 60 cm (2 ft) of compacted soil, including 6 inches of topsoil. Financial assurance is required.[43]

NEW YORK

New York defines *construction and demolition waste, landclearing debris,* and *inert waste.* Long Island is located in a sensitive groundwater recharge zone, and therefore, landfills on Long Island are regulated somewhat differently than the rest of the state. Minimum requirements for C&D debris disposal facilities located outside Long Island are described here. A single composite liner with a leachate collection system is required. The composite liner must be a geomembrane with a minimum thickness of 1.5 mm (60 mil) that directly overlays an 45 cm (18 inch) soil layer (the top 15 cm [6 inch] having a maximum permeability of 1×10^{-7} cm/s). Groundwater monitoring is required. Location restrictions include prohibition from unstable areas, unmonitorable or unremediable areas, floodplains, primary water supplies, mines or caves, and bedrock with rapid or unpredictable groundwater flow. Minimum distances are required from airports. Operator training and waste spotters are required for all landfill facilities. The final cover must be composed of a gas-venting layer, a barrier layer or geomembrane, a barrier protection layer, and a topsoil layer. Financial assurance is required. C&D debris processing facilities have operator training, waste spotter requirements, and waste reuse and storage requirements.[44]

NORTH CAROLINA

North Carolina is currently developing new C&D debris rules. North Carolina does not currently require a liner system. The new rules will assess the attenuation properties of the underlying soils and evaluate the suitability of the soils for attenuation purposes. Although groundwater monitoring is not specified in the C&D landfill regulations, requirements are located in the solid waste rules. The Department of Environment and Natural Resources (DENR) may require groundwater monitoring depending on factors including the design of the facility, the type of waste a facility will handle, the geology of the area, and the proximity and usage of groundwater that may be affected by the facility. The DENR currently uses the regulatory monitoring requirements as a template for structuring the groundwater monitoring requirements for C&D landfills. Landfills are restricted from floodplains; areas where the facility may negatively impact the habitat of endangered or threatened species; sites

where archaeological or historical sites are at risk; locations that may impact a state park or recreation or scenic area; or land included in a state preserve. Operator training is not required. Although spotters are not required, a waste screening system must be in place to notify DENR within 24 hours if a nonauthorized waste is brought to the facility for disposal. Final cover must stabilize the site with native grasses within 6 months of final disposal. The proposed rules require financial assistance at closure.[45]

NORTH DAKOTA

North Dakota regulates *inert waste* landfills, which include wastes generated from C&D activities. *Inert waste* is broadly defined to include C&D debris, although C&D debris is not formally defined by the regulations. As natural clay-rich soils are readily available in most parts of the state, no formal liner system for inert waste landfills is required, although compacted clay may be necessary if the native soil is not adequate. Inert waste landfills are typically limited to those locations with clay-rich soils. Landfills are prohibited from areas that may be negatively impacted by the facility or affect human health or environmental resources, and from other locations that are unsuitable due to topography, geology, hydrology, or soils. Groundwater monitoring is not required. Operator training is voluntary, and guidelines for those programs are available from the North Dakota Department of Health (DOH). Spotters are not required. Final cover must be at least 60 cm (2 ft) thick with the lower portion consisting of 30.5 cm (12 in) of compacted clay. If compacted clay is not used, then the final cover must be at least 1.22 m (4 ft) thick and consist of clay-rich soil. Financial assurance is not required.[46]

OHIO

Ohio defines *construction and demolition* and *clean hard fill*. Although the following wastes do not fall under the definition for C&D debris, incidental packaging, tree limbs and trunks greater than 10.2 cm (4 in) in diameter, and NESHAP asbestos with a facility air permit can be accepted at a C&D debris landfill. If in situ soils meet the minimum thickness requirement of 1.53 m (5 ft) with permeability 1×10^{-5} cm/sec or have a maximum permeability equal to 60 cm (2 ft) of soil with permeability of 1×10^{-6} cm/sec, then no liner is required. Otherwise, a natural liner must be constructed of recompacted soil at least 61 cm (24 in) thick with a maximum permeability of 1×10^{-6} cm/sec. Groundwater monitoring is not required unless minimum distances from aquifer system, public water supply well, wellhead protection area, source water protection areas, and developed springs to the waste boundary at a facility are not met. At that point, monitoring is required to determine if the groundwater quality has changed.

Landfills are prohibited from placement above a sole source aquifer or in a floodplain. Operator training is not required. Although a spotter is not required, a daily log of material brought into the landfill must be maintained,

and each load must be taken to an unloading zone for screening prior to delivery to the work face. Final cover must include 46 cm (18 in) of a barrier layer, 15 cm (6 in) of fertile soil, dense vegetation, and a slope between 3 and 25%. If the site is to be developed into a parking lot or other purpose, other final cover requirements may apply. Financial assurance consists of $13,000 per acre and $2175 per monitoring well if present.[47]

OKLAHOMA

Oklahoma recently adopted the following definition for construction/demolition waste:

> (A) asbestos-free waste from construction and/or demolition projects that may include such materials as metal, concrete, brick, asphalt, glass, roofing materials, limited amounts of packing materials, sheetrock, or lumber;
> (B) wood waste that may include such materials as yard waste, lumber, wood chips, wood shavings, sawdust, plywood, tree limbs, or tree stumps;
> (C) yard waste that may include such materials as grass clippings, tree limbs, tree stumps, shrubbery, flowers, or other vegetative matter resulting from land clearing or landscaping operations; or
> (D) residential lead-based paint waste.[53]

A liner is required for C&D debris landfills. The liner may be a reconstructed clay liner with a minimum thickness of 91 cm (3 ft) and a hydraulic conductivity no greater than 1×10^{-5} cm/sec, or the liner may consist of in situ soils being a minimum of 1.5 m (5 ft) thick with a hydrulic conductivity no greater than 1×10^{-5} cm/sec. Groundwater monitoring is required. Location restrictions set limitations according to proximity to floodplains, airports, wetlands, endangered species, scenic rivers, recreation areas, terrace deposits, surface public water supplies, and public water supply wells. The Department of Environmental Quality (DEQ) must be notified the next day if any wastes are rejected as prohibited waste at C&D landfills or processing facilities. This requirement inherently requires spotting of the waste at any C&D facility. Final cover is a minimum 91 cm (3 ft) thick soil layer with a maximum top slope of 25:1 and a maximum side slope of 4:1. Vegetation must be grown on top of the soil layer. Financial assurance is required.[48]

OREGON

Oregon defines *construction and demolition wast. Clean fill, industrial waste, inert waste*, and *domestic solid waste* explicitly exclude C&D waste from their definitions. Depending on the location and the type of waste accepted, a liner system may be required. For instance, a small C&D landfill in western

Oregon, where the annual rainfall is high, is more likely to be required by the Oregon Department of Environmental Quality (DEQ) to install a liner system than an equivalently sized landfill in eastern Oregon, which is an extremely dry region. Groundwater monitoring is a conditional requirement. If the DEQ is not sure the groundwater will be safe from contamination, liner systems, leachate collection, and groundwater monitoring can be required. Operator training and spotters are not required, but facilities must screen the waste to comply with any permit prohibitions of certain wastes.

Nonmunicipal landfills are forbidden from locations that will cause harm to endangered or threatened species including plants, fish, and wildlife. Further limitations include floodplains and locations near sensitive hydrogeological environments. Final cover must include at least 91 cm (3 ft) of compacted soil graded to a minimum 2% and maximum 30% slope unless the department authorizes an alternative final cover design. Nonmunicipal land disposal sites must maintain financial assurance for the costs of closure, post-closure, and any required corrective action. C&D waste sites may be exempted from these costs if the site can be demonstrated to pose no threat to groundwater or public health and not require any operation or maintenance to control discharges into the environment.[49]

PENNSYLVANIA

Pennsylvania defines *construction and demolition waste* and *construction waste*. A liner system is required for C&D debris landfills. Each liner system must be composed of a subbase, a leachate detection zone, a liner, and a protective cover, which consists of another leachate detection zone, that are approved under the minimum liner design standards. The subbase should be a solid or other earthen material 6 inches thick with permeability no greater than 1×10^{-5} cm/sec. The leachate detection zone is placed on top of the subbase to collect and transmit any leachate entering the zone to a leachate treatment system. This zone should be at least 30.5 cm (12 in) thick and create a flow zone between the subbase and liner with permeability greater than 1×10^{-2} cm/sec.

Several options for the liner layer are allowed. The liner may consist of a continuous layer of remolded clay, geosynthetic material, or sodium bentonite placed on the leachate detection zone and be no more permeable than 1×10^{-7} cm/sec. The thickness of the layer is determined by the type of material; 60 cm (2 ft) for the clay liner, 0.76 mm (30 mil) for the geosynthetic liner, and 1 ft for the sodium bentonite liner. If the liner is a composite liner, then the upper geosynthetic component should meet the requirements independently of the natural component and vice versa. The final layer of the liner system, the protective cover and leachate collection zone, must be composed of at least 46 cm (18 in) of clean, earth material with a permeability of at least 1×10^{-2} cm/sec, allowing for the free flow of leachate. Groundwater monitoring is required. Spotters are required to monitor waste

brought to the facility, and a person trained in the weighing of waste must be present.

Facilities are prohibited from floodplains, wetlands, coal-existing areas unless operator owns mineral rights, valley, ravine, head of hollow, limestone, or carbonate formation. Facilities must adhere to minimum distance requirements from occupied dwellings, perennial streams, water sources, schools, and playgrounds, and waste must be 30.5 m (100 ft) from the property line. Facilities are prohibited from being an obstruction to air navigation.

Final cover includes a cap, a drainage layer, and compacted soil. The permeability should be less than or equal to the permeability of the primary liner or no greater than 1×10^{-7} cm/sec, whichever is less. The compacted soil layer should be at least 60 cm (2 ft) thick and placed on top of the drainage layer.

Financial assurance is required. The facility application should contain a plan for the salvaging and recycling waste materials for which recycling is cost effective. The plan should include proposed salvage areas, methods for salvaging, and anticipated markets for salvaged materials. The salvaging and recycling of materials may not be conducted unless the operator oversees salvaging and recycling operations to prevent interference with disposal operations and to ensure that all operations are conducted in a manner that prevents a health hazard or nuisance. In addition to these restrictions, all salvaged material should be moved promptly from the unloading area and either stored in an approved area or immediately transported off site.[50]

RHODE ISLAND

Rhode Island no longer has operating C&D landfills. By the end of 2000, only three operating landfills were in the state.[52] Although some C&D debris is disposed within the MSW landfills, most C&D debris is sent to processing facilities. These facilities are regulated under Rhode Island Code. The requirements for processing facilities are defined within state solid waste regulations and are similar to landfill requirements (e.g., monitoring requirements, location requirements, and operator requirements).

The Rhode Island Department of Environmental Management (DEM), depending on certain site characteristics, may require groundwater monitoring. Groundwater monitoring requirements depend upon the size, type, location, and length of storage of on-site waste stockpiles, as well as the proximity to public or private drinking wells, surface water, and wetlands.

Operator training is not required. Although spotters are not required, the facility must have an operating plan that includes methods for screening, handling, and removing of unauthorized waste. A buffer zone between the waste and the property line should be established to minimize dust, odor, and litter problems. Other location restrictions apply to waste being used as alternative daily cover or reused. Waste screenings from processed waste may not be used within certain proximity to surface water or wetlands or within

public drinking water supply, and a plan is required for monitoring maximum contaminant limits. Wood chips from land clearing debris may be used for landscaping mulch, soil amendment, sewer sludge amendment for composting, and erosion control material. Wood chips that contain segregated building or demolition wastes may only be used as fuel or erosion control projects at landfills upon DEM approval. Processing facilities are required to have financial assurance.[51]

SOUTH CAROLINA

South Carolina expects to revise its C&D rules within two years. No liner is currently required, but a landfill must have a minimum 60 cm (2 ft) soil barrier above the seasonal high groundwater level (i.e., the base of the landfill must be at least 60 cm (2 ft) above the seasonal high water table). Groundwater monitoring is not required. No certification for operators is necessary, although spotters must be present for waste screening purposes. Facilities may not be located in areas that would restrict the flow in a 100-year floodplain and in wetlands. Waste must not be disposed within 30.5 m (100 ft) of the property line. Minimum distances are required from schools, hospitals, publicly owned parks, drinking water wells, and utility equipment such as water, sewer, and power lines. The final cover must be composed of 60 cm (2 ft) of earth, have a 1 to 4% surface slope, and be graded to promote drainage. The side slopes of the cover should be no greater than 3:1. Financial assurance is required.[55]

SOUTH DAKOTA

State defines *construction and demolition waste.* No liner or groundwater monitoring is required. Operator certification is not required. Operators are required to maintain access control at disposal sites and conduct weekly site inspections. C&D debris disposal facilities may dispose of authorized waste (no asbestos or asphalt) in gravel pits or quarries. Location is restricted and should minimize significant adverse impacts to the public, surface water, ground water, wildlife, recreation, or aesthetic value of an area. Facilities are prohibited from a 100-year floodplain, unstable areas, or wetlands. The facility may maintain a buffer between itself and occupied dwelling, school, hospital, interstate or highway right-of-way, public park or recreation area, streams, creeks, lakes, reservoirs, or other bodies of water classified for fish life propagation. Final cover requires 60 cm (2 ft) of soil, an incorporation of contours into contours of surrounding area, and vegetation in accordance with Natural Resources Conservation Service (NRCS) recommendations.[56]

TENNESSEE

Tennessee defines *construction and demolition debris*, which is typically disposed in a class IV landfill. A liner system is not required, but a minimum 1.5 m (5 ft) layer of geologic buffer between the base of the fill and the

seasonal high water table of the aquifer directly under the waste must have saturated hydraulic conductivity of no more than 1.0×10^{-5} cm/sec. Location restrictions include minimum distances from streams and other water bodies. Groundwater monitoring is not required, although the Tennessee Department of Environment and Conservation (DEC) may require monitoring depending on the location of the facility. Operator training and spotters are not required, but permits generally require a storage container at the unloading area for removal and storage of any unauthorized waste. Final cover includes at least 76.2 cm (30 in) of compacted soil. The bottom 46 cm (18 in) must consist of a low-permeability layer covered by a 30.5 cm (12 in) vegetative layer. Financial assurance includes the cost of operating the facility for a 30-day period plus the estimated closure and postclosure care costs included in the approved care plan for two years after facility closure.

Recycling facilities must apply for a solid waste-processing permit. Facilities are permitted by rule, which means that they must notify the department of compliance with general operating criteria. Processing facilities for C&D debris are increasing in popularity, with 8 to 10 facilities currently operating. However, landfills remain the most viable option, with 50 to 60 active class IV landfills in the state.[57]

TEXAS

Construction and demolition waste contains waste resulting from construction or demolition projects; includes all materials that are directly or indirectly the by-products of construction work or that result from demolition of buildings, and other structures, including, but not limited to, paper, cartons, gypsum board, wood, excelsior, rubber, and plastics. Texas sends nonhazardous solid waste to several types of MSW landfills. Type IV MSW landfills may be authorized for the disposal of brush, construction-demolition waste, and/or rubbish that are free of putrescible, household waste, and special wastes. A liner system is required for Type IV MSW landfills. The liner may be composed of (1) at least 1.22 m (4 ft) of in situ soil with permeability no greater than 1×10^{-7} cm/sec between the deposited waste and groundwater or (2) at least 91 cm (3 ft) of compacted clay between the deposited waste and groundwater. The compacted clay liner must have at least 30 cm (1 ft) of protective cover after quality control testing and thickness determinations are complete. Groundwater monitoring is required except at arid exempt facilities.

Current location restrictions limit facilities from locating within 274 m (300 yards) of a public road unless the Texas Commission on Environmental Quality approves the proposed location. A new permit or permit modifications require compliance with the minimum distance restrictions or prohibitions from airports, floodplains, wetlands, fault areas, seismic impact zones, and unstable areas. As of January 1, 2004, operator training is mandatory. Spotters are required to direct unloading of solid waste. Final cover consists

of a layer to minimize infiltration and a layer to minimize erosion. The layer to minimize infiltration must be at least 46 cm (18 in) of clayey soil, classification SC or CL as defined in the "United Soils Classification System" developed by the U.S. Army Corps of Engineers, compacted in layers of no more than six inches to minimize the potential for water infiltration. A CH soil may be used; however, this soil may experience excessive cracking and must be covered by a minimum of 12 inches of topsoil to retain moisture. Other types of soil may be used with prior written approval. The layer to minimize erosion must be a minimum of 15 cm (6 in) of suitable topsoil capable of sustaining native plant growth and must be seeded or sodded immediately following the application of the final cover. Financial assurance is required.[58]

UTAH

Utah has no liner or groundwater monitoring requirements. However, if a C&D landfill accepts CESQG waste, groundwater monitoring is required and all location standards in the regulations must be met. If no CESQG waste is accepted, the location of the facility need only meet floodplain and wetland requirements and be at least 1.5 m (5 ft) above the groundwater table. With different requirements based upon the type of waste accepted, each landfill must ensure that the waste received is acceptable for disposal at that facility. Although not specifically required, a spotter completes this task. Final cover at a facility should have a minimum of 60 cm (2 ft) of soil contoured to allow runoff and seeded to prevent erosion. Financial assurance is required for closure and postclosure.[61]

VERMONT

C&D debris disposal falls under discrete waste disposal in Vermont. Under this classification, Vermont requires a double liner system composed of natural and synthetic material. However, the Vermont Agency of Natural Resources has the authority to waive liner requirements if a facility can demonstrate through a detailed site-specific hydrogeologic study and contaminant transport modeling that the waste components received on-site do not generate leachate that may cause harm to public health or the environment or create nuisance conditions. Groundwater monitoring is required. Facilities must detect any discharge of contaminants to surface water or air.

C&D landfills are prohibited from the Green Mountain National Forest, Class I and Class II groundwater area, Class I and II wetlands and buffer zones, Class III wetlands unless waved, national wildlife refuge, wildlife management area, threatened or endangered species habitat area, watershed for Class A waters, floodway, or 100-year floodplain, or near outstanding natural resource waters. Facilities should be located to not unduly harm the public health and to have the least possible reasonable impact on the environment if an emission or discharge occurs. Operators need to be experienced and knowledgeable, but no specific training is required. Requirements for final

cover vary depending on whether a facility has a liner. One C&D debris landfill in Vermont is constructed without a liner; as a minimum, its final cover is composed of at least 60 cm (2 ft) of earthen material with a permeability of less than 1×10^{-5} cm/sec or the facility base soils (whichever is less permeable), and at least 15 cm (6 in) of earthen material to sustain native vegetation. Financial assurance is required. Recycling is required and must include metal, cardboard, and other materials specific to the facility.[62]

VIRGINIA

Virginia defines *construction waste, demolition waste, debris waste, inert waste*, and *rubbish*. The type of landfill that accepts C&D debris is defined as a *Construction/Demolition/Debris landfill (CDD landfill)*. A CDD landfill accepts construction waste, demolition waste, debris waste, or combinations of the solid wastes just listed.

Either a compacted clay liner or a geomembrane liner must underlie the CDD landfill. The compacted clay liner must be at least 30.5 cm (12 in) in thickness, and must have a hydraulic conductivity less than or equal to 1×10^{-7} cm/sec. The geomembrane liner must be at at least 0.76 mm (30 mil) thick (1.5 mm (60 mil) if HDPE). In either case, a minimum slope of 2% must be maintained for leachate drainage, and the liner must be covered with a minimum 30.5 cm (12 in) thick drainage layer having a permeability not less than 1×10^{-3} cm/sec, and minimum 15.3 cm (6 in) thick protective layer.

Groundwater monitoring is required. The groundwater monitoring system must have at least one upgradient well, and three down-gradient wells. However, a double liner system can be used in lieu of groundwater monitoring. In this case, the lower, or secondary liner, must meet the same requirements as the primary liner. The double liner must include a 30.5 cm (12 in) thick drainage layer between the primary and secondary liner to serve as a "witness zone." The witness zone drainage layer must have a permeability not exceeding 1×10^{-3} cm/sec. While a double liner system can be used, it should be noted that no CDD landfill has been built with that design.

Operator training, which includes the implementation of an unauthorized waste control program, is required. Location restrictions for CDD landfills include prohibitions from areas susceptible to flooding, geologically unstable areas, and minimum distance requirements from any residence, school, hospital, groundwater source of drinking water, and wetlands.

Final cover must consist of an 45.7 cm (18 in) thick layer of earthen material with hydraulic conductivity less than or equal to the hydraulic conductivity of any bottom liner system, or natural subsoils present, but in no case no greater than 1×10^{-5} cm/sec to minimize infiltration. A minimum 5.3 cm (6 in) thick layer of earthen material capable of sustaining native plant growth is required on top to minimize erosion. Financial assurance is required.[63]

WASHINGTON

The regulations define *demolition waste* and *inert waste*. C&D debris is typically disposed in a limited purpose landfill, which, unless exempt, requires a composite liner system. A 3 m (10 ft) barrier must exist between the lowest component of the liner and the highest seasonal level of groundwater. The lower component of the liner should consist of a minimum 60 cm (2 ft) layer of compacted soil with hydraulic conductivity of no more than 1×10^{-7} cm/sec. The upper component must be a geomembrane made of HDPE with minimum of thickness of 1.5 mm (60 mil). The facility must have a leachate collection and monitoring system capable of maintaining less than a 1 ft head of leachate over the liner system. A limited purpose landfill may be designed and constructed without a liner system if it can be demonstrated that (1) contaminant levels in waste and leachate are unlikely to adversely impact the environment, (2) in situ soils provide a sufficient barrier or are capable of reducing the concentration of contaminants sufficiently to meet performance standards, and (3) explosive gases are not generated in concentrations above state limits by the facility.

Groundwater monitoring is required. Operator training is required and includes identification of unauthorized waste. Spotters must ensure that no liquids or liquid waste are disposed at the facility and must follow an established random inspection program. The facilities may not be located on Holocene fault. The facility must adhere to minimum distance requirements from structures and natural areas including water supplies; channel migration zones such as streams, lakes, ponds, rivers, or saltwater bodies; wetlands or public lands; and airports.

Final cover should consist of a geomembrane overlain by an anti-erosion layer. The geomembrane should be at least 0.76 mm (30 mil) thick. The anti-erosion layer should be earthen material at least 60 cm (2 ft) thick with the upper 30 cm (12 inches) capable of sustaining native plant growth. Financial assurance is required. Recycling facilities may accept source-separated C&D debris. Other recycling restrictions are specified within the permits.[64]

WEST VIRGINIA

West Virginia defines *construction and demolition debris*. No liner, groundwater monitoring, operator training, waste spotters, or financial assurance at C&D landfills is required; however, facilities are prohibited from locating in areas where the facility could adversely impact the environment. A facility is limited to 0.81 ha (2 acres) and may only be as high as an existing, adjacent contour. Facilities are restricted from locating near wetlands, areas harboring endangered or threatened species, areas where facility may significantly affect surface or groundwater, floodplains, highways, public parks, dwellings, airports, fault areas, mines, and other unstable areas. Final cover

should include 61 cm (24 in) of clean earthen material over the fill area capable of sustaining plant growth.[66]

WISCONSIN

Wisconsin defines *construction* and *demolition debris*. Wisconsin places C&D landfills into two categories: small-sized C&D landfills and intermediate-sized C&D landfills. The minimum requirements, which apply to the small-sized C&D landfills, are discussed unless otherwise noted. A clay liner at least 91 cm (3 ft) thick is required with a hydraulic conductivity of 1×10^{-7} cm/sec or less when compacted. A 3 m (10 ft) barrier should exist between the seasonal high groundwater table and/or bedrock and the bottom of the liner. Groundwater monitoring and operator training are required. A waste-screening plan must be in place and for intermediate-sized landfills must include training personnel in the identification of unauthorized wastes. Minimum distance requirements must be maintained from any public or private water supply well; any navigable lake, pond or flowage; any highway, interstate, or public park unless the landfill is screened; and any navigable river or stream. A landfill is not permitted in a floodplain. Final cover should include 60 cm (2 ft) of compacted earth with an adequate slope for water runoff covered by 15 cm (6 in) of topsoil. Financial assurance is required.[67]

WYOMING

Wyoming defines *construction/demolition waste.* A liner system and groundwater monitoring are generally not required; however, groundwater monitoring may be required on a case-by-case basis depending on site characteristics. Operator training is required, although a spotter for identifying unauthorized waste is not.

Location restrictions include minimum distance requirements for facilities greater than 0.41 ha (1 acre) in size, including distances of 1 mile from a public school, occupied dwelling house, and boundaries of an incorporated city or town, and 0.8 km (0.5 mile) from the centerline of the right-of-way of a state or federal highway (unless screened) and from water wells. Minimum distance are required for any size facility from an occupied dwelling house, school, hospital, interstate, primary highway, public park, or recreation area unless screened; water source; buildings unless protected from methane gas accumulation; perennial river or stream unless the facility will not affect it; and perennial lake or pond unless the facility will not affect it. Facilities are prohibited within a 100-year floodplain, wetlands, areas where facility may diminish the scenic, recreational, and fish and wildlife values for any section of river designated for protection, areas where a threat may be posed to an irreplaceable historic or archeological site, critical habitats of endangered or threatened species or winter ranges for big game or breeding grounds for grouse, areas where facility may negatively affect surface water

or groundwater quality, and areas determined to present a dust, odor, or public nuisance potential. Final cover consists of a compacted layer of soil 60 cm (2 ft) thick covered with at least 15 cm (6 in) of topsoil. Financial assurance is required for commercial or private landfill facilities but not municipal facilities.[68]

CONCLUSIONS

Issues involving C&D debris have recently become more of a concern than they traditionally were in the past. Since no federal definition or management requirement for C&D debris exists, this waste stream is handled individually by each state. The survey results presented here found that the definitions and regulations that states apply to C&D debris are not consistent. Almost half of the states have some sort of liner requirement for C&D landfills, indicating that these states do think C&D disposal could have an impact on the environment. However, the lack of consistent liner and groundwater requirements among states suggests that states may be unclear about the environmental risk of C&D debris disposal in landfills. Federal regulation or guidance could standardize the level of environmental protection for these landfills. As more information is learned on the fate of compounds found within C&D debris, the need for federal guidance on this waste stream may arise. At the least, a federal definition of C&D debris would be beneficial to facilitate research efforts and to address this issue in a more uniform manner.

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Estimated Costs and Benefits of Implementing these Requirements

We do not believe that there would be any additional costs associated with this requirement.

Comment 9 – Additional Certification Requirements

The OAG also requests that the Board adopt a requirement in the final rules that requires generators of bulk materials which are disposed of at CCDD fill facilities to provide a certification to the Illinois EPA that all of the disposed bulk materials meet the proposed definition of "Clean construction or demolition debris," under Proposed Section 1100.103 ("Definitions").

Estimated Costs and Benefits of Implementing these Requirements

We do not believe that there would be any additional costs associated with this requirement.

Respectfully submitted

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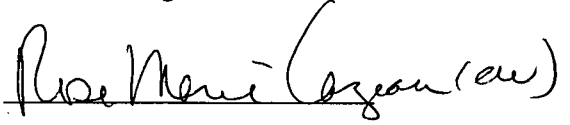
By: 

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