Perspectives on Liability for Constructive Reuse of High-Volume Waste Streams

BARRY K. PARTRIDGE, JAMES E. ALLEMAN, AND BRENT W. HUBER

Large quantities of high-volume waste streams (HVWS), such as coal combustion by-products (CCBPs) and waste foundry sands (WFS), are landfilled in the United States annually. Waste generators facing increased landfill costs, reduced landfill space, and stringent permitting requirements are pursuing reuse options. Departments of transportation (DOTs) face growing pressure from waste generators, national associations, state legislatures, and the general public to find acceptable reuse applications for HVWS in roadway applications. Research results generally have been favorable toward the geotechnical and construction properties of CCBP and WFS. Furthermore, generators have been willing to provide the waste material to the job site at no cost, in lieu of incurring landfill tipping fees. Many DOTs, including the Indiana DOT (INDOT), have developed special provisions, specifications, and protocols for reusing HVWS. State and federal regulatory agencies typically have classified WFS as a solid waste under the Resource Conservation and Recovery Act (RCRA), while CCBP is excluded from RCRA regulation as a hazardous waste. WFS and CCBP can be excluded from Indiana RCRA solid waste regulation when used as a roadbase material. Despite these promising efforts, DOTs remain reluctant to reuse HVWS because of potential liability, primarily resulting from Superfund. Efforts by the 104th Congress to revise Superfund liability failed to address HVWS. Consequently, INDOT is developing a testing protocol to minimize liability and is considering indemnification clauses, which represent an added cost. Primarily liability issues are discussed here.

Large quantities of domestic, industrial, and mining waste are generated annually in the United States. According to the Environmental Protection Agency (EPA), municipal solid waste (MSW) alone constituted 163 million Mg (180 million tons) in 1988 (of which 72.7 percent was landfilled) and was projected to reach 181 million Mg (200 million tons) by 1995 (*1*). Other high-volume waste streams (HVWS) such as coal combustion by-products (CCBP) and waste foundry sands (WFS) typically have been reposed to landfills as well. GAI Consultants, in a report on the use of CCBP in highway construction, point out that of the 79 million Mg (87 million tons) of CCBP produced in the United States in 1990, 59 million Mg (65 million tons) was disposed in landfills (*2*). In Indiana alone more than 400 000 Mg (450,000 tons) of WFS is produced annually, according to the Indiana Cast Metals Association, with the majority of the waste sand deposited in landfills. As the generation of waste continues to increase, the capacity to handle it is decreasing. Many landfills have closed, and new facilities are often difficult to site because of economic and environmental constraints (*1*).

With increased landfill costs, reduction in available landfill space, and stringent permitting regulations, there still has not been an increased use of "environmentally acceptable" HVWS in construction projects, although HVWS generators frequently offer their waste material at no cost to reusers to avoid tipping fees at restricted waste landfills. Research conducted nationally or sponsored by industry associations such as the Electric Power Research Institute and the American Foundrymen's Association shows the constructability, geotechnical suitability, and environmental acceptability of many CCBP and WFS reuse streams. Numerous state departments of transportation (DOTs) (e.g., Pennsylvania, Wisconsin, Ohio, and Indiana) have developed or drafted testing protocols toward the reuse of waste materials, yet use lags far behind the production of these potentially beneficial reuse materials.

The recurring reason for the underutilization of HVWS is the potential liability that end users face under federal and state legislation such as the Resource Conservation and Recovery Act (RCRA) and the Comprehensive, Environmental Response, Compensation and Liability Act (CERCLA), better known as Superfund. Proposed Superfund liability reforms considered by the 104th Congress failed to address liability concerns or provide incentives for reusing HVWS (*3*).

This paper provides a historical overview of the Indiana Department of Transportation (INDOT) efforts in the reuse of HVWS and potential DOT liability, as well as of the efforts of INDOT and various state DOTs in developing testing protocols for reuse applications. This paper also briefly examines the need for liability reform under current legislation and the efforts by INDOT to develop a total testing protocol (TTP) toward minimizing any resultant liability.

BACKGROUND

INDOT, like many other DOTs, has been actively involved in recycling and reusing wastes generated by DOT activity. Principal waste materials being recycled or reclaimed include recycled asphalt and concrete paving materials, coal fly ash as a cement substitute in concrete paving and low-strength flowable fill, and blast furnace and steel slag as an aggregate, an abrasive material mixed with deicing agents, or a sandblasting material. Other recyclable or reuse materials include refurbished aluminum signs, recycled cast iron delineators, waste motor oil used as a fuel source, rubber tires processed as an asphalt additive or fuel source, and waste batteries.

A study performed by Purdue University for INDOT in May 1991 found that 27 waste products had been used by 42 state transportation agencies (*4*). Nationally, DOTs' recycling and reuse efforts mirrored INDOT's, with DOTs typically using those wastes generated internally. Interestingly, at the time, state DOTs considered only reclaimed paving materials and fly ash as more economical than virgin materials. Furthermore, the engineering properties and performance of waste materials were not considered superior to virgin materials. State DOTs did think, however, that the reuse of waste

B. K. Partridge, Indiana Department of Transportation, P.O. Box 2279, West Lafayette, Ind. 47906. J. E. Alleman, School of Civil Engineering, Purdue University, West Lafayette, Ind. 47907. B. W. Huber, Stuart & Branigin, The Life Building, P.O. Box 1010, Lafayette, Ind. 47902.

materials was environmentally sound and prudent, although the basis for their conclusion was unclear or, typically, not based on first-hand experience.

As landfilling became increasingly unattractive, waste generators approached INDOT in 1991 through the legislature by mandating that Purdue and INDOT examine the feasibility of reusing six waste streams in road construction, including coal combustion products, waste tires, ebonite materials (found in waste batteries), foundry sand, building demolition materials, and recycled asphalt pavement. Fortunately for INDOT, the Indiana General Assembly mandated only a feasibility study and not the reuse of the waste materials. Although the reuse of HVWS, such as CCBP and WFS, appeared promising, other waste materials such as ebonite and building demolition materials were much less desirable.

In 1991 the U.S. Congress passed the Intermodal Surface Transportation Efficiency Act (ISTEA); along with directing the U.S. DOT and EPA to conduct studies on the reuse of recycled materials in highway construction, ISTEA mandated that state DOTs incorporate crumb rubber modifier in hot mix asphalt paving, eventually, in at least 20 percent of the asphalt tonnage placed. This latter requirement has been rescinded.

Most states, including Indiana, currently regulate CCBP and WFS as a solid waste under federal or state RCRA regulations and exempt CCBP from hazardous waste regulation under RCRA (5). In Indiana, foundry sand that is demonstrated as "suitable" [i.e., passing a designated EP toxicity test (chemical analysis of leachate provided from EP tox test leaching procedure) and neutral pH leaching method test] as a restricted waste Type III material (Tables 1 and 2) can be excluded from regulation as a solid waste when used as a base for road building. (Type IV materials are excluded.) Foundry owners, convinced that their residuals are perfectly safe for reuse, have even claimed that their waste streams are "cleaner than dirt."

LIABILITY

Even though some waste streams were conveyed as "cleaner than dirt," INDOT still had questions of DOT liability with the reuse of HVWS materials in roadway construction, primarily liability beyond that incurred with virgin materials. In the fall of 1994, INDOT asked environmental attorneys to issue an opinion on INDOT's exposure (potential liability) under RCRA and CERCLA from the beneficial reuse of spent ferrous foundry sands. Ferrous foundry sands (or green sand molding sands) comprise 85 to 95 percent of the 408 150 Mg (450,000 tons) of WFS produced annually by Indiana foundries and have been found to be generally "cleaner" than waste sands resulting from chemically bonded and shell molding processes. In short, the attorneys' opinion (November 1994) stated:

> Spent foundry sands that are used as a base in road building are excluded from Indiana's RCRA regulations if the sands satisfy certain toxicity tests. As long as the sands in question satisfy these technical criteria, IDEM complies with the regulations regarding this exclusion, and the sands are used as a base in road building, INDOT should not incur any liability for this use under RCRA.
>
> Even if the sands in question satisfy Indiana's RCRA exclusion, however, there does not appear to be any reason why INDOT (and possibly the generator) could not be liable under federal CERCLA if the spent foundry sands used in road construction contaminate the groundwater or otherwise become the subject of a CERCLA clean up action. This may be unlikely, but it is a risk given the courts' current interpretation of CERCLA.

Their opinion raised but did not address the extent to which state Occupational Safety and Health Administration (OSHA/IOSHA) regulations may apply to INDOT's employees or contractors who are exposed to regulated contaminants in spent foundry sands during construction.

The legal reasoning and case law for INDOT RCRA and/or CERCLA liability using waste materials (e.g., WFS) is given in the following.

RCRA

RCRA generally applies to the generation, transportation, treatment, storage, and disposal of "hazardous waste" (42 U.S.C. §9601 et seq.; Ind. Code §13-7-8 5-1 et seq). Indiana's regulations on identifying hazardous waste generally adopt the federal rules in 40 C.F.R. Part 261 (329 Ind. Admin. Code §31-6-1). Under these federal rules, to be a "hazardous waste," a substance must first be a "solid waste" [42 U.S.C. §6903(5)]. A "solid waste" is any "garbage, refuse, and other discarded material . . ." [Id §6903(27)]. RCRA's regulations define solid waste as any "discarded material" that is

a) Abandoned (by being disposed, burned, incinerated, or stored prior thereto), or

TABLE 1 Indiana Restricted Waste Criteria for Parameters Using EP Tox Test or TCLP

	EP Tox Test or TCLP(mg/L)			
Metal Species	**Type IV**	**Type III**	**Type II**	**Type I**
Arsenic	≤0.05	≤0.5	≤1.25	<5.0
Barium	≤1	≤10	≤25	<100
Cadmium	≤0.01	≤0.1	≤.0.25	<1.0
Chromium	≤0.05	≤0.5	≤1.25	<5.0
Lead	≤0.05	≤0.5	≤1.25	<5.0
Mercury	≤0.002	≤0.02	≤0.05	<0.2
Selenium	≤0.01	≤0.1	≤0.25	<1.0
Silver	≤0.05	≤0.5	≤1.25	<5.0

Indiana Administrative Code (IAC), Section 329, Article 2, "Solid Waste Management," Rule 9, Part 3 (i.e. 329 IAC 2-9-3)

TABLE 2 Indiana Restricted Waste Criteria for Parameters Using Leaching Method Test

	Leaching Method Test (mg/L)			
Metal Species	**Type IV**	**Type III**	**Type II**	**Type I**
Barium	≤1	≤10	≤25	*
Boron	≤2	≤20	≤50	*
Chlorides	≤250	≤2,500	≤6,250	*
Copper	≤0.25	≤2.5	≤6.25	*
Cyanide, total	≤0.2	≤2	≤5	*
Fluoride	≤1.4	≤14	≤35	*
Iron	≤1.5	≤15	*	*
Manganese	≤0.05	≤0.5	*	*
Nickel	≤0.2	≤2	≤5	*
Phenols	≤0.3	≤3	≤7.5	*
Sodium	≤250	≤2,500	≤6,250	*
Sulfate	≤250	≤2,500	≤6,250	*
Sulfide, total	≤1	≤5	≤12.5	*
Total dissolved solids	≤500	≤5,000	≤12,500	*
Zinc	≤2.5	≤25	≤62.5	*

*Testing not required
Indiana Administrative Code (IAC), Section 329, Article 2, "Solid Waste Management," Rule 9, Part 3 (i.e. 329 IAC 2-9-3)

b) Inherently waste-like, or

c) A secondary material (i.e., any spent material, sludge, by-product, etc.), when recycled in any of the following four ways

1) Used in any manner constituting disposal;

2) Burned for energy recovery used to produce a fuel or contained in fuel,

3) Reclaimed; or

4) Accumulated speculatively. (See generally 40 C.F.R. §26.2)

When Indiana adopted these federal RCRA rules about the definitions of solid and hazardous waste in 1992, it retained certain exclusions relating to foundry sand in its regulations. [329 Ind. Admin. Code 3.1-6-1(b) (1994 Suppl.); 329 Ind. Admin. Code 2-3-1] These exclusions provide that the following activities are excluded from Indiana's solid waste RCRA program.

(14) The legitimate use of foundry sand which has been demonstrated as suitable for restricted waste site Type III under the provisions of 329 IAC 2-9, including the use as a base for road building, but not including use for land reclamation except as allowed under subdivision (15).

(15) Other uses of solid waste may be approved by the commissioner if the commissioner determines them to be legitimate uses that do not pose a threat to public health and environment. [329 Ind. Admin. Code 2-3-1(14) & (15)]

For foundry sand to satisfy this exclusion, it must satisfy the technical criteria in 329 Ind. Code 2-9-3(d) (2) regarding foundry waste disposed of at a restricted waste site Type III. These testing requirements include an EP toxicity test [chemical analysis of leachate produced from EP tox test leaching procedure] for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver, and, among other things, a leaching method test for such things as chlorides and phenols. Spent foundry sands that satisfy this exclusion are not subject to Indiana's RCRA program if they are put to "legitimate use," such as a base for road building [Id. 2-3-1(14)]. In addition to the roadbase definition, INDOT must satisfy environmental siting criteria [329 IAC 10-33-1(a)(1–6)].

Even if INDOT's use of spent foundry sands is exempt from Indiana's RCRA program because the sands are "nontoxic" and are used as a base in road construction, the question remains whether CERCLA may apply.

CERCLA

CERCLA, as well as Indiana's mini–Superfund statute (Ind. Code §134-7-8.7-1 et seq.), authorize the government (and private parties in some instances) to take action in response to the "release or substantial threat of release" of any "hazardous substance" regardless of the effect of the release on the environment, or of "any pollutant or contaminant which may present an imminent and substantial danger to the public health or welfare" [42 U.S.C. 9604(a)(1).] Hazardous substances include RCRA hazardous wastes and numerous other listed chemicals [Id. §9601(14)].

Liability under CERCLA will not lie unless (*a*) the site is a "facility," (*b*) a "release" or a "threatened release" of a "hazardous substance" has occurred or is occurring, (*c*) the release or threatened release has caused response costs to be incurred, and (*d*) the defendant falls within one of the classes of responsible persons listed in CERCLA §107(a), 42 U.S.C. 9607(a) [*Kerr-McGee Chemical Corp v. Lefton Iron & Metals Co.*, 14 F.3d 321, 325 (7th Cir 1994), reh'g denied].

"Facility" includes any site or area where a hazardous substance is located [42 U.S.C. §9601(9)]. The universe of potentially responsible parties includes governments as well as private persons who (*a*) are owners or operators of a facility, (*b*) owned or operated the facility at which the hazardous substances were disposed at the time of disposal, (*c*) by contract or otherwise arrange for the disposal of hazardous substances (a/k/a "arrangers" or "generators"), and (*d*) persons who accept hazardous substances for transport to disposal or treatment facilities from which there is a release or threatened release ("transporters") [see 42 U.S.C. §9607(a)].

A letter from the Ohio Cast Metals Association dated November 19, 1993, suggests that INDOT arguably should be able to avoid

CERCLA liability because the foundry sands are being reused such that they are not discarded, disposed of, or abandoned. Stated differently, this argument is that the sands in question are not a waste. Under CERCLA, "disposal" has the same meaning as under federal RCRA [Id. §9601(29)]. There, "disposal" references the term "waste" [Id. §6903(3)]. The courts that have addressed such arguments, such as in *Catellus Development Corp. v. United States*, 34 F.3d 748 (9th Cir. 1994), have concluded that the case law about the definition of "disposal," "discarded material," "waste," and so on under RCRA applies to CERCLA cases as well. (The court in *Catellus* relied heavily on cases construing RCRA's definition of 'disposal' in holding that a party who sold spent automotive batteries to a lead reclamation plant could be liable under CERCLA as one who "arranges" for the disposal of a hazardous substance. 34 F.3d at 752-52).

Definitions

A series of cases have analyzed the meaning of "discarded material," "disposal," and "waste" under RCRA. First, in *American Mining Congress v. United States*, 824 F.2d 1177 (D.C. Cir. 1987) (*AMC I*), the court addressed whether Congress used the term "discarded" in RCRA in its ordinary sense—disposed of or abandoned—or whether it used the term more broadly to encompass materials no longer useful in their original capacity, though destined for immediate reuse in another phase of an ongoing production process (824 F.2d at 1185). In *AMC I*, the court concluded that Congress used the term in the former manner and held that only materials that are disposed of or abandoned can be regulated under RCRA (*Id.*at 1186).

Next, the court in *American Petroleum Institute v. United States*, 906 F.2d 729 (D.C. Cir 1990), expanded the definition of "discarded material." There, EPA maintained that the holding in *AMC I* precluded it from regulating as RCRA hazardous waste certain slag materials if these materials were to be delivered to a plant for metal reclamation. The *American Petroleum* court disagreed, maintaining that

> The issue in [*AMC I*] was whether the EPA could, under the RCRA, treat as 'solid wastes' "materials that are recycled and reused in an *ongoing* manufacturing or industrial process." We held that it could not because "[t]hese materials have not yet become part of the waste disposal problem; rather, *they are destined for beneficial reuse or recycling in a continuous process by the generating industry itself*." Materials subject to such a process were not 'discarded' because they were never "disposed of, abandoned, or thrown away." . . . Unlike the materials in question in *AMC I*, [the slag in question] is indisputably 'discarded' *before* being subject to metals reclamation. Consequently, it *has* "become part of the waste disposal problem." [*American Petroleum*, 906 F.2d at 741 (citations omitted and emphasis in original).]

Even though this reading of the *AMC I* case was not entirely accurate, the *American Petroleum* court held that the slag material at issue could be regulated under RCRA because it was discarded or abandoned by the industry for a time *before* it was delivered to the plant for metal reclamation (see id.).

Later, in *American Mining Congress v. United States*, 907 F.2d 1179 (D.C. Cir. 1990) (*AMC II*), the court again expanded the definition of "solid waste." There, the petitioners, in reliance on *AMC I*, argued that three types of materials at issue were not solid wastes because the sludges that contained these materials were stored in surface impoundments for a time before they were to be reclaimed. The *AMC II* court rejected the petitioners' reading of *AMC I*, explaining

> Petitioners read *AMC I* too broadly. *AMC I's* holding concerned only materials that are "destined for immediate reuse in another phase of the industry's ongoing production process," and that "have not yet become part of the waste disposal problem." Nothing in *AMC I* prevents the agency [EPA] from treating as 'discarded' the wastes at issue in this case, which are managed in land disposal units that are part of wastewater treatment systems, which have therefore become "part of the waste disposal problem," and which are not part of the ongoing industrial processes. [*AMC II*, 907 F.2d at 1186 (citations omitted)]

The same issue arose again in *United States v. ILCO, Inc.*, 996 F.2d 1126 (11th Cir. 1993). There, ILCO purchased spent batteries from various sources and then recycled them. It contended that, because it recycled the spent batteries, the batteries had not been discarded and were therefore not a solid waste. The *ILCO* court disagreed, insisting that although the lead components in the spent batteries were valuable for ILCO's purposes, these materials were discarded solid waste because someone upstream had discarded the battery in which these components were found. The fact that someone had discarded the battery upstream "does not change just because a reclaimer has purchased or finds value in the components" (966 F 2d at 1131).

The Fourth Circuit recently addressed this issue again in *Owen Electric Steel Co. v. Browner*,—F.3d—, 1994 WL 554,656 (4th Cir. Oct. 12, 1994). Owen produced steel in an electric arc furnace. During production, crushed limestone was added to the furnace to remove certain nonferrous constituents from the molten metal. In this process, the nonferrous materials combined with the limestone, creating slag material containing trace amounts of metallic oxides. After the slag floated to the surface of the molten metal, Owen would remove it and place it in holding bays. The slag generally would lie in these holding bays for approximately 6 months on bare soil, where it would cure. After the slag cured, Owen sold the slag to the construction industry for use as a road base material and other commercial purposes (1994 WL 554,656, at $*$ 1).

After reviewing the relevant cases, the *Owen Electric* court concluded that the "fundamental inquiry in determining whether a byproduct has been 'discarded' is whether the byproduct is immediately recycled for use in the same industry; if not, then the byproduct is justifiably seen as 'part of the waste disposal problem,' and therefore as a 'solid waste' " (Id. at $*$ 4). Because Owen's slag was not immediately used in Owen's production process, and was left untouched in holding bays for approximately 6 months before it was sold, the court concluded that "it cannot be said that the material was never 'disposed of, abandoned or thrown away' " [Id. (quoting *American Petroleum*, 906 F.2d at 741)]. As a result, even though Owen ultimately sold its slag to others for use in roadbed construction, the court held that Owen's slag was subject to RCRA because it was not "destined for beneficial reuse or recycling in a continuous process by the generating industry itself" (Id.).

Implications for Potential CERCLA Liability

According to the courts in *Owen Electric*, *ILCO*, *AMC II*, *American Petroleum*, and *Catellus Development*, whether a material is "discarded" or "disposed of" for purposes of federal RCRA (and by definition CERCLA) turns on whether the material in question is immediately used or recycled in a continuing process by the generating industry. Under this test, the foundry sands that INDOT would acquire from foundries are almost certainly disposed of for purposes of CERCLA. Although INDOT may be able to distinguish cases such as *Owen Electric* somewhat if there is no need for the foundry sands to cure for 6 months or so, the courts' reasoning suggests that

even if INDOT reused the sand immediately, the sand will be considered discarded because the reuse is by someone other than the foundries that generated the sands.

INDOT probably cannot argue that the foundry sands are waste vis-a-vis the foundries and nonwaste for INDOT's purposes. Although most of the cases addressing this question approach the problem from the perspective of the industry, or "seller" of the material, it is clear from the decision in *ILCO*, 966 F.2d 1126, that this makes no difference in terms of INDOT's exposure as an end user. In *ILCO*, even though the buyer or user of the spent batteries recycled them to obtain valuable lead components from the batteries, the court concluded that the batteries were discarded solid waste because someone upstream had discarded them (996 F.2d at 1131). As a result, according to the *ILCO* court, even though INDOT may be obtaining the foundry sands for beneficial purposes, this does not change the status of the sands as discarded material or a disposed of waste for purposes of the analysis.

As such, the foundry sands would be subject to CERCLA to the extent that they are a hazardous substance. A "hazardous substance" includes RCRA hazardous waste and, among other things, any "imminently hazardous chemical substance or mixture" that is the subject of a cleanup action under CERCLA, but it does not include any waste that has been excluded from federal RCRA by an "Act of Congress" [see 42 U.S.C. §9601(14), 40 C.F.R. §302.4 (listing numerous regulated hazardous substances)]. The question that this definition raises is whether foundry sands that satisfy Indiana's RCRA exclusion can be regulated as a hazardous substance under federal CERCLA.

EPA has not taken a position on this question (at least not one that is published), and there does not appear to be any reported case law on point (as of November 1994). However, cases regarding certain slag and ash mining wastes (known as Bevill wastes), which have been exempted from federal RCRA by Congress, suggest that foundry sands probably can be the subject of a CERCLA cleanup action as a hazardous substance, even though they are excluded from Indiana's RCRA program. For instance, the courts in *Louisiana-Pacific Corp. v. ASARCO, Inc*., 24 F.3d 1565, 1572–1575 (9th Cir. 1994) and *Eagle-Picher Industries v. U S EPA*, 759 F.2d 922 (D.C. 1985), which appear to represent the majority rule, held that Bevill wastes are subject to CERCLA if they contain other regulated hazardous substances, such as copper, lead, arsenic, and zinc. The *ASARCO* court also held that the "waste" in question could simultaneously be a useful product for purposes of state law and a hazardous substance for purposes of CERCLA (24 F.3d at 1575). *United States v. Iron Mountain Mines, Inc.*, 812 F.Supp.1528 (E D. Cal. 1992), an earlier case that reached the opposite conclusion, was implicitly overruled by *ASARCO*.

These cases thus suggest that spent foundry sands can be regulated under CERCLA as a hazardous substance, even if they satisfy Indiana's RCRA exclusion. Testing performed by Purdue University on behalf of INDOT has shown that spent foundry sands, for instance, may contain fluorides and nonmetal compounds such as coal tar derivatives and possibly other contaminants that may present environmental complications. Any such sands would probably contain regulated CERCLA hazardous substances and could therefore be the subject of a subsequent cleanup action for which INDOT could be liable [*see, e.g.*, 40 C.F.R. §302.4 (listing numerous fluorides and other regulated hazardous substances)].

Under CERCLA, there does not appear to be any legitimate reason that INDOT could not be liable for cleanup costs if the foundry sands in question are the subject of a subsequent cleanup action. According to the leading cases analyzing what constitutes discarded material for purposes of RCRA and, by definition, disposal of a waste under CERCLA, INDOT's use of spent ferrous foundry sands for a base in road construction probably constitutes disposal or a solid waste. If these sands exhibit characteristics of a hazardous waste or contain hazardous substances or otherwise pose a threat to the environment, these sands could be deemed a hazardous substance for purposes of CERCLA. There is therefore some risk that INDOT and the generators of the foundry sands could expose themselves to liability under CERCLA, even if the foundry sands are exempt from Indiana's RCRA provisions.

Because CERCLA is a federal statute, there probably is no state legislative solution to this problem. To the extent that the foundry sands satisfy Indiana's RCRA exclusion, it would appear unlikely that they would pose a serious threat to the environment or otherwise become the subject of a CERCLA cleanup action. However, this is a technical question that one should weigh carefully in view of CERCLA's expansive definition of "hazardous substance." Right now there does not appear to be any legal reason that INDOT (and possibly the generators) could not be liable under CERCLA if INDOT uses spent foundry sands as a base in road building and these sands contaminate groundwater or otherwise threaten the environment. INDOT may be able to minimize its exposure somewhat by obtaining an indemnification agreement from the generators/sellers of the sands. Similar reasoning (i.e., potential liability under Superfund) would apply to the reuse of CCBP.

SUPERFUND REFORM

A series of events beginning with the publishing of Rachel Carson's *Silent Spring* in 1962 have brought environmental pollution issues to the forefront of public attention. Discovery of the toxic dump in Love Canal, New York, and its related health effects, for instance, added impetus to the passage of CERCLA, otherwise known as Superfund. Much of the major environmental legislation passed in the early 1970s in the United States represented a significant departure from past policies.

Liability under Superfund is broad in its scope of enforcement; in an effort to pay remediation costs, administrators and judges have had incentives to further broaden Superfund's liability. Liability under Superfund typically was retroactive (although current cases such as *U.S. v. Olin Corp* is challenging retroactive liability) so as to include responsible persons dating to the origination of the released contaminants. Furthermore, substances that were not deemed hazardous in the past may be deemed hazardous today, resulting in subsequent liability. Furthermore, "proper disposal methods" in the past may be deemed unacceptable by today's standards, again resulting in subsequent liability.

Liability under Superfund is also strict liability, that is, liability is not based on fault and is supported by ample case law (e.g., *United States v. Tex-Tow, Inc., Colorado v. Asarco, Inc., United States v. Wade*, etc.; however, in *United States v. Windstar Corp.* application of strict liability requires causation as an element of Superfund liability). The result is that the release need not be of a particular defendant's waste for that defendant to be liable.

Finally, as a general rule (subject to certain exceptions), liability under Superfund is joint and several, meaning each potentially responsible party (PRP) can be liable for all costs incurred in a cleanup. Although CERCLA does not explicitly call for joint and several liability, some courts' interpretations have imposed this liability on PRPs. Consequently, Superfund—which legislators

envisioned as the large solution to cleaning up hazardous waste sites—in reality has resulted in further litigation, created relatively little actual site remediation, and inhibited other environmentally friendly programs such as the recycling and reuse of waste materials.

One foregone environmental opportunity is the reuse of HVWS, which has been brought to a virtual standstill, in many instances, by potential Superfund liability. Although recycling and reusing HVWS makes environmental sense by reducing the need for virgin materials, reusers are reluctant to reuse the waste material, even when deemed nonhazardous by exhaustive testing, when such a potential for future liability exists.

CERCLA/SARA liability could be revised to promote the reuse of nonhazardous HVWS such as many CCBP and WFS. Recently, Superfund liability reforms were contained within HR 2500 IH and SB 1285, *Reform of Superfund Act of 1995*, but were not passed by the 104th Congress (*3*). While a complete review of the proposed liability reforms is beyond the scope of this paper, it is noteworthy that Section 215, Title II, *Clarification of Liability for Recycling Transactions* within HR 2500 attempted to address liability associated with recycling of "recyclable materials." For instance, "a person who arranged for the recycling of recyclable material shall not be liable." "Recyclable material means scrap paper, scrap plastic, scrap glass, scrap textiles, scrap rubber (other than whole tires), scrap metal, or spent lead-acid, spent nickel cadmium and other spent batteries." Unfortunately, HVWS such as CCBP and WFS are not mentioned.

HR 2500 attempted to address potential hazardous material contamination of recyclables with language such as "minor amounts of material, reasonable care," and exclusion (i.e., therefore, liable) if "the person added hazardous substances to the recyclable material for purposes other than processing for recycling." Interpretation by administrators and the courts most likely will lead to further litigation and continued reluctance to use recycled or HVWS. Instead, or in addition, a statistically based testing protocol could be instituted that a HVWS (or recyclable material) would have to pass prior to use. Once passed, the suitability of the material is settled with regard to the reuser's liability. In short, Congress could pass definitive legislative reform of Superfund liability replacing subjective interpretation with the objective criterion of a TTP.

While no testing protocol is 100 percent accurate, 100 percent of the time with a TTP in place a hazardous substance release would be the exception rather than the rule. Furthermore, it is likely that HVWS generators would be willing to pay a surcharge to fund a cleanup in return for avoiding costly landfill tipping fees. Even environmentally conscious reusers may be willing to pay a "cost" for the opportunity to use a reuse material in lieu of virgin materials as long as the costs remained relatively comparable.

TOTAL TESTING PROTOCOL

Pending Superfund liability reform, INDOT requires indemnification agreements when reusing WFS and, in some instances (although not consistently), CCBP. Some consideration is being given to requiring indemnification agreements for all waste material reuse applications, claiming that if the generator's material is "cleaner than dirt," as some WFS generators suggest, there should not be a reluctance on the generator's part to sign an indemnification agreement.

While indemnification agreements are enforceable between the parties under CERCLA, they do not serve as a defense to liability, hence, a state DOT (for instance) would remain a PRP and liable to an environmental agency. The DOT would have recourse under the indemnification only so long as the indemnitor remains solvent and continues to exist. Additionally, indemnification agreements may or may not be enforceable under a state equivalent of CERCLA, and generators retain liability as ones who "arrange for disposal" under CERCLA and are not 'off the hook' because of having given or sold the waste products to the DOT. Indemnification agreements, furthermore, represent a cost and exposure to generators in terms of potential liability and may affect generators' willingness and ability to provide HVWS at no cost to the contractor or DOT. (INDOT researchers have estimated a 50 percent savings on inplace embankment fill, when using an HVWS such as a CCBP.)

INDOT is working with Purdue University and FHWA, in conjunction with IDEM, toward developing of a TTP (*6*) to minimize INDOT's potential liability when using an HVWS, without overburdening Indiana industry with additional, expensive, chemical-specific testing, which may preclude the reuse of the HVWS. In addition to a designated EP toxicity test and neutral pH leaching method test, both of which are currently required for restricted solid wastes, a bioassay test (*7*) utilizing the bacteria *vibrio fischeri* to screen WFS for toxicity has proven successful. Ideally, the goal is to develop a minimum TTP for HVWS to minimize the likelihood of a hazardous substance release and resultant liability.

To date INDOT has constructed three embankments using CCBP totaling over 78 800 m^3 of fill. One embankment was constructed with bottom ash (20 630 m^3), and the other embankments were constructed with commingled bottom ash (minimum 65 percent of total ash) and fly ash. A fourth embankment using more than 56 000 m^3 of commingled coal ash is currently under construction, as is an embankment using 38 200 m^3 of green ferrous foundry sand. WFS is also permitted for use in flowable fill, as is CCBP, although ready-mix companies have expressed concern with their potential liability when using WFS.

It is interesting to note how environmental characterization "criteria" for reuse materials, which generators and end users must evaluate, is evolving in difficulty (Table 3). For example, the Indiana and Ohio policies were developed before 1966, and the number of parameters to be tested is far lower than what has since been written into the newer (1996) policies for Pennsylvania and Wisconsin (draft). Furthermore, older Indiana and Ohio policies only address "leachate levels," while the latest Pennsylvania and Wisconsin (draft) policies are now calling for total elemental analyses as well as leachate analysis. Rather obviously, there is an escalating attempt in these newer policies to reduce risk by asking for more stringent testing, but at the same time the associated cost to comply with these levels of higher testing will escalate accordingly, and possibly become so costly as to prevent the intended reuse effort.

Although all of these policies specify stringent limitations on a variety of chemical contaminants, they bear a surprising range of "fuzziness" in how the wastes will actually be tested, in terms of how many samples are to be run and how they are to be collected. In some cases, these policies require only a "representative" sample as determined by the generator. None of these policies asks for more than three samples, again with sample collection and suitability depending heavily on the discretion of the generator. In short, even though the testing in question involves extremely sophisticated instrumentation able to detect contaminants at extraordinarily low levels, the validity of these results would appear to be open to considerable interpretation based on the laxity of the 'upfront' stipulations on the number and type of samples subjected to testing.

Perhaps another look needs to be taken at the economic reality of waste disposal issues. Indeed, there is a possibility of overregulating "wastes" to such extremes, in terms of obviating risk, thereby affecting the economic survival of the industries. As a case in point, coke production in the United States is now so tightly regulated that it is actually cheaper, in some instances, for the raw coal to be shipped overseas, coked in foreign plants, and then shipped backed to domestic users. Regulatory agencies and end users, concerned with potential liability, by expanding environmental testing criteria can realistically price beneficial reuses of HVWS out of the market. Understandably, there is a valid argument for continued source reduction and striving to make wastes continually cleaner; however,

TABLE 3 Summary of Representative Regulatory Characterization Criteria

		Indiana [a]	Ohio [b]	Pennsylvania [c] (foundry sand)	Wisconsin [d] (draft)
Total Elemental Metal	Al				x-Coal ash/slag
	Sb			x	x
	As			x	x
	Ba			x	x-Coal ash/slag
	Be			x	x
	Bo				x-Coal ash
	Cd			x	x-Coal ash
	Cr-Total			x	x
	Cr-Hexavalent			x	
	Cu			x	
	Pb			x	x-Coal ash/slag
	Mn			x	
	Hg			x	x-Coal ash
	Mo				x-Coal ash
	Ni			x	x-Coal ash
	Ag			x	
	Se			x	
	Ag			x	
	Th			x	x
	Va				x-Coal ash
	Zn			x	x-Coal ash
Other-Inorganic	CN-Total	x	x-WFS	x	x-WFS
	F	x	x-WFS	x	x
	pH	x		x	
	Cl	x			x-Coal ash
	SO_4^{-2}	x			x
	S^{-2}	x			
	Na	x			x
	$NO_2^- + NO_3^-$				x-Coal ash
	TDS	x			
	K	x			
Other-Organic	1-methyl naphthalene				x
	2-methyl naphthalene				x
	Acenaphthene				x
	Acenaphthylene				x
	Anthracene				x
	Benz(a)anthracene				x
	Benz(a)pyrene				x-WFS
	Benzene			x	x
	Benzo(b)fluoranthene				x
	Benzo(ghi)perylene				x
	Benzoic Acid			x	
	Chrysene				x
	Dibenz(ah)anthracene				x

(*continued*)

TABLE 3 Continued

		Indiana	Ohio	Pennsylvania (foundry sand)	Wisconsin (draft)
	Ethylbenzene			x	x
	Fluoranthene				x
	Fluorene				x
	Indeno(123-cd)pyrene				x
	Napthalene			x	x
	PHCs-Total			x	
	Phenanthrene			x	x
	Phenols-Total	x	x-WFS	x	x-WFS
	Pyrene				x
	Resorcinol			x	
	Toluene			x	
	TOX			x	
	Trimethlybenzene			x	
	Xylene			x	
Leachate	Al			x	x
Metal	Sb			x	x
	As	x	x	x	x
	Ba	x	x	x	x
	Be			x	x
	Bo	x			x-Coal ash
	Ca	x			
	Cd	x	x	x	x
	Cr-Total	x	x	x	x
	Cu	x		x	x
	Fe	x		x	x
	Pb	x	x	x	x
	Mn			x	x
	Mg	x			
	Hg	x	x	x	x
	Mo			x	x-Coal ash
	Ni			x	x
	Se	x	x	x	x
	Ag	x		x	x-Coal ash
	Th			x	x
	Zn	x		x	x

(a) Indiana Department of Environmental Management, Solid Waste Management, Indiana Administrative Code (IAC), Section 329, Article 2, Rule 9, Part 3 (i.e. 329 IAC 2-9-3).

(b) Ohio Department of Environmental Protection, Department of Solid Waste Policy No. DSW 0400.007, 7 November 1994.

(c) Pennsylvania Department of Environmental Protection, General Permit for Processing/Beneficial Use of Residual Waste, Permit No. WMGR019, 22 April 1996.

(d) Wisconsin Department of Natural Resources, Draft, Chapter NR 538: Beneficial Reuse of Industrial By-Products, 1 February 1996.

some waste will likely persist as long as the industry exists. Past experience has shown that benign HVWS, which beneficially could be reused in roadway projects, at a savings to taxpayers, is being landfilled.

Furthermore, the media have, at times, dramatized the severity of environmental problems, to the point at which the public may lose sight of the true priorities in terms of risk. This has led the public to believe falsely that Congress' environmental advocacy can provide them with regulations that will do away with risk altogether. In turn, the public has come to assume that risk levels for a reuse project could be eliminated by upfront testing, not realizing that the associated costs may prevent the reuse all together. During the INDOT WFS reuse project, INDOT researchers were repeatedly called by the local public, indicating the foundry's sand "used to be toxic," when in fact the foundry's sand was one of the cleanest sands tested in the state. Public disinformation of

this sort can quickly create a highly negative mood toward reuse applications.

SUMMARY

HVWS generators such as utilities and foundries are producing large quantities of CCBP and WFS, respectively, with most of the waste deposited in restricted waste landfills. HVWS generators facing increased landfill costs, reduced landfill space, and stringent permitting requirements are pursuing reuse options, such as roadway applications.

State DOTs, such as INDOT, are facing increased pressure from HVWS generators, national associations, state legislators, and an environmentally conscious general public to find acceptable reuse applications. Indeed, past research generally has shown CCBP and ferrous WFS to be suitable as geotechnical and construction materials. However, DOTs, as end users, remain concerned with potential liability stemming from reuse applications, liability beyond that normally incurred with virgin materials. For instance, INDOT, when considering the reuse of WFS, was advised by environmental attorneys that even if the WFS is excluded from Indiana RCRA regulations, INDOT could still be liable under CERCLA (Superfund) if the spent foundry sand contaminates the groundwater or otherwise become the subject of a CERCLA cleanup action. While indemnification agreements may provide some relief, DOTs still remain understandably cautious, considering CERCLA's broad and encompassing liability provisions.

Efforts toward reforming Superfund liability were unsuccessful in the 104th Congress. Proposed liability reforms addressing recyclable materials did not deal with HVWS such as CCBP and WFS. Congress could replace subjective criteria contained in Superfund with objective criteria using a statistically based testing protocol. Unilaterally, INDOT is attempting to develop a TTP that a HVWS must pass, before use, in an attempt to minimize potential INDOT liability resulting from a hazardous substance release, yet without overburdening Indiana industry with numerous, costly tests.

Interestingly, state regulatory agencies and DOTs' "environmental characterization criteria" are evolving in difficulty from leachate levels to additional total elemental analyses. The general public, while wanting generators and DOTs to find "acceptable" reuse options can lose sight of economic reality in terms of acceptable risk, preferring regulations that do away with risk altogether. Indemnification clauses and additional regulations can represent real costs and exposure (e.g., when mixed with other waste or virgin materials) to generators and end users, which realistically may preclude the beneficial reuse of HVWS. Until the liability issues associated with HVWS are properly addressed, HVWS reuse will probably remain a goal instead of a reality.

REFERENCES

1. *Characterization of Municipal Solid Waste in the United States: 1990 Update*. Report EPA/530-SW-90-042. Environmental Protection Agency, 1990.
2. Brendel, G. F. *Progress Report: Use of Coal Combustion By-Products in Highway Construction, State of Indiana*. GAI Consultants, 1992.
3. U.S. Congress. House. *Reform of Superfund Act of 1995.* 104th Cong., 1995, H.R. 2500 IH.
4. Ahmed, I. *Use of Waste Materials in Highway Construction*. Final Report FHWA/IN/JHRP-91/3. Joint Highway Research Project, 1991.
5. Environmental Protection Agency. *Wastes from the Combustion of Coal by Electric Power Plants.* Report to Congress. Washington, D.C., Feb. 1988.
6. Alleman, J. E., and B. K. Partridge. *Enhanced Constructive Waste Reuse Using Bioassay Characterization*. Priority Technology Program Proposal INPTP-002. FHWA, U.S. Department of Transportation, 1995.
7. Bastian, K. C., and J. E. Alleman. *Environmental Bioassay Evaluation of Foundry Waste Residuals.* Final Report FHWA/IN/JHRP-96-4. Joint Highway Research Project, 1996.

Publication of this paper sponsored by Committee on Environmental Issues in Transportation Law.