

US EPA ARCHIVE DOCUMENT

APPENDIX B  
CASE STUDIES OF  
BENEFICIAL USES OF FOUNDRY SAND

Reuse of Foundry Sand in Soil Amendments – Ohio  
Reuse of Foundry Sand in Highway Construction – Wisconsin  
Reuse of Foundry Sand in Asphalt Production – Michigan  
Reuse of Foundry Sand as Parking Lot Fill – West Virginia

## REUSE OF FOUNDRY SAND IN SOIL AMENDMENTS – OHIO

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### Description of Beneficial Reuse Activity

Kurtz Brothers, Incorporated, produces and sells landscape products, including compost, soil, and mulch. For the past 20 years Kurtz has collected sand from foundries in Ohio for use in a variety of soil blending products. Each of Kurtz's production facilities uses the same "recipes" for the company's blended soil products, which are based on the recommendations of the Ohio Agriculture Research and Development Center at Ohio State University.

The vast majority of the sand collected from foundries by Kurtz is generated by ferrous operations, with the remainder coming from aluminum casting operations. Of the approximately 20 foundries from which Kurtz hauls sand, the Ford Foundry in Brookpark, Ohio, has been Kurtz's largest and most consistent source since the two companies entered into a hauling arrangement in 1986. The Ford facility produces only ferrous castings and generates approximately 1,000 tons of used sand per day. This sand goes directly into holding tanks, from which it is collected by Kurtz for hauling to its facility in Groveport, Ohio. A small percentage of sand generated at the Ford facility, primarily from the core preparation room and floor sweepings, is disposed of in a landfill.

In 2001, Kurtz collected approximately 270,000 tons of sand: nearly 241,000 tons from the Ford foundry, and a combined total of 28,000 tons from other foundries. During the same year, Kurtz used approximately 238,000 tons of foundry sand in its products, including 77,240 tons in the production of 180,000 cubic yards of soil blends.<sup>1</sup> Kurtz sells its soil products to approximately 225 customers consisting primarily of garden centers/nurseries and landscapers.

Dugan's Garden Center is a typical customer of Kurtz Brothers. Dugan's began to carry blended soil products from Kurtz in the late 1980s and currently carries three Kurtz products: *Pro-Blend*, which is a primary topsoil product consisting of sand and organic materials; *Ultra*

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<sup>1</sup> Besides the soil blend products, Kurtz Brothers used 130,000 tons of sand in structural fill, 12,000 tons in flowable fill, 12,000 tons in day cover and final cover at landfills, 5,000 tons in custom backfill, and 2,000 tons in traction control products. The difference in sand collected (270,000 tons) and sand used in products (238,000 tons) represents 32,000 tons of sand stored on-site for future reuse.

*Compost*, a biosolids-based compost; and another organic, leaf-based compost. In terms of volume, Dugan's purchases and in turn sells 2,200-2,500 cubic yards of *Pro-Blend* a year.

## **Relevant Regulatory Framework in Ohio**

### *Ohio Beneficial Use Policy*

The Ohio Environmental Protection Agency's (Ohio EPA's) Division of Surface Water issued Policy Number 400.007, "*Beneficial Use of Nontoxic Bottom Ash, Fly Ash and Spent Foundry Sand, and Other Exempt Waste*," on November 7, 1994. The policy was issued in response to the large number of requests regarding reuse of certain industrial by-products (including foundry sands) that had been handled on a case-by-case basis. In some cases, the policy allows reuse without prior notification. This applies to specific materials, types of beneficial reuse, and contaminant concentrations. In the case of reusing foundry sand as a soil blending product, this policy restricts the volume of foundry sand to 50 percent of a commercial soil product "where the product will be used for growth of trees or ornamentals (not including sod farms)," and the product cannot be applied to grazed pastures or home food gardens, or used for growing crops.

### *Specific Permitting/Regulatory Requirements for Kurtz Brothers*

Ohio's waste classification system established in Policy 400.007 consists of four beneficial use categories. Unlike other states, Ohio's "categories" do not correspond solely to types of beneficial uses, concentration thresholds, or volumes of sand reused. Instead, each category represents a combination of these three characteristics (i.e., the beneficial reuse, concentration thresholds, and volume of sand reused). Ohio EPA allows the most flexibility under Category 1 and the least flexibility under Category 4. (Ohio's waste classification system established by Policy 400.007 is discussed in more detail in Appendix A.)

Under Policy 400.007, Kurtz Brothers received a Category 4 approval in 1996 to manage sand from the Ford Foundry for five years. The Category 4 approval allowed Kurtz to manufacture soil blending products consisting of up to 20 percent foundry sand, provided the sand met certain contaminant concentration thresholds. Kurtz also needed to receive Ohio EPA consent and notify Ohio EPA of the reuse at least 60 days prior to commencing the reuse project. The remaining sand used by Kurtz from other foundries qualifies as Category 1 under Policy 400.007, which means that neither notification of Ohio EPA nor Agency review is required prior to reuse.

On December 6, 2001, shortly before the original approval was to expire, Kurtz Brothers and Ohio EPA agreed on a Permit-To-Install (PTI), which gives Kurtz more flexibility in how it could use foundry sand from Ford, provided the sand and final soil amendment products meet more stringent concentration thresholds. Specifically, the PTI allows for unrestricted use of foundry sand in blended soil products "for general use marketing" in commercial, residential, or agricultural applications, as long as the volume of sand in products does not represent more than 50 percent of the total volume of product and the following conditions are met:

- **Annual testing by Ford** of the leachate from its sand using the Toxicity Characteristic Leaching Procedure (TCLP). The leachate cannot exceed Ohio's drinking water Primary Maximum Contaminant Levels, 10 times Ohio's Secondary Maximum Concentration Levels, or additional limits for lead and phenol. If Ford changes its manufacturing process or the materials used in production, it must test the leachate from the new process to verify that no applicable regulatory thresholds are exceeded.
- **Quarterly TCLP testing by Kurtz** of the final soil amendment products containing foundry sand. Blended soil amendments containing foundry sand must be monitored quarterly for nine metals, and must meet limits that are equivalent to twice the limits found in U.S. EPA's 503(c) sludge regulations for the "clean tier."<sup>2</sup>
- **Submission of an annual report** from Kurtz Brothers to Ohio EPA that includes at a minimum: (1) the results of the annual TCLP monitoring of the foundry sands; (2) the results of the quarterly total metals monitoring of the soil blends; (3) any "interferences" with the project (e.g., spills); and (4) the results of any research on foundry sand recycling conducted by, or for, Kurtz.

### **Product Performance**

By many accounts, Kurtz's *Pro-Blend* topsoil is superior to other manufactured soils not made with foundry sand. In addition, the *Pro-Blend* topsoil and other Kurtz blended soils containing foundry sand are looser, less compact, more permeable, and easier to work with than the local topsoil, which has a relatively high clay content. Dugan's Garden Center first chose to carry, and has continued to carry, Kurtz's topsoil product because: (1) there was no other topsoil blend product on the market in the late 1980s; (2) the high quality of the product (Dugan's believes *Pro-Blend* continues to perform better than other topsoils); and (3) it has always been price-competitive (Dugan's sells the *Pro-Blend* topsoil product for \$26 per cubic yard, and the two Kurtz Brothers compost products for \$22 per cubic yard). Those interviewed for this case study were satisfied with the performance, engineering characteristics, and quality of final soil products containing foundry sand.

Ohio EPA is confident that its classification system and method for evaluating the reuse of foundry sand, which focus on determining an appropriate list of contaminants (such as metals, cyanide, fluoride, and phenols) for testing and establishing protective limits, provides ample environmental safeguards. This confidence is supported by the fact that representatives at Ohio EPA, Kurtz, Ford, and Dugan's are not aware of any environmental problems associated with reusing foundry sand for soil amendment, nor have they heard of any end users experiencing environmental problems from Kurtz's products containing foundry sand. Furthermore, Ohio EPA is generally not concerned with potential environmental hazards associated with the reuse

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<sup>2</sup> *The Standards for the Use or Disposal of Sewage Sludge*, Title 40 of the Code of Federal Regulations, Part 503.

of non-hazardous foundry sand, and is not aware of any instances of environmental damage resulting from reusing foundry sand.

### **Economic and Operational Effects**

#### *Kurtz Brothers' Perspective*

Kurtz Brothers charges a fee to foundries for hauling and processing their sand. Kurtz uses a four-tiered fee structure that is determined by the composition of the foundry sand, its anticipated final use, and the transportation distance. No additional capital investment was required on the part of Kurtz to begin collecting and processing foundry sand. Overall, Kurtz estimates its costs of manufacturing soil products with foundry sand to be similar to the costs of manufacturing soil products before Kurtz used this sand as a raw material.

The only barrier preventing Kurtz from using more foundry sand in its products is the increased transportation cost associated with extending the network of foundries from which they collect sand. To obtain sand from additional foundry customers, Kurtz would have to increase the hauling fee to a level that would not be competitive with landfill tipping fees.

#### *Ford's Perspective*

Without investing any additional capital, Ford has been able to realize several economic and operational benefits by sending its sand to Kurtz Brothers. These benefits are typical of foundries sending sand to Kurtz. Before the existing hauling arrangements, foundries would dispose of sand either in foundry-owned monofills or in off-site landfills. The tipping fees for off-site disposal were \$15 per ton for non-hazardous waste in 1985 and have since ranged from a high of almost \$30 per ton to the current \$10 per ton. In the time Kurtz and Ford have maintained their hauling arrangement, Ford estimates that its cost for sand disposal has decreased by two-thirds.

Additionally, the change from landfilling to reuse eliminated Ford's dependence on the off-site landfill's having the daily capacity to accept Ford's full shipment of sand. In the past, Ford was forced to stockpile its sand for future disposal whenever the landfill reached its daily capacity. Capacity is not an issue now that Kurtz is responsible for hauling the sand from the foundry, which significantly streamlines the handling of the sand.

## REUSE OF FOUNDRY SAND IN HIGHWAY CONSTRUCTION - ENCAPSULATED STRUCTURAL FILL – WISCONSIN

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### Description of Beneficial Reuse Activity

Waupaca Foundry's interest in the beneficial reuse of foundry sand began in the mid-1980s when it participated in a research study at the University of Wisconsin-Madison on the potential use of foundry sand in highway construction. Foundry sand from Waupaca and two other foundries was tested to identify any potential environmental impacts associated with contaminant levels in pore water and leachate. In 1990, this research was expanded into a pilot study at a state Department of Transportation (DOT) highway construction project, with Waupaca providing 15,000-20,000 tons of sand.

Currently Waupaca is under contract with the DOT to provide 80,000 tons of sand to be used as structural fill in constructing embankments for Highway 10 near the city of Waupaca. For a 10-month period beginning in 2001, all of Waupaca's foundry sand was hauled to a temporary staging location near the future highway site, in anticipation of summer 2002 construction activities. The nature of Waupaca's process allows the sand to be taken directly for use without any further screening or treatment. The embankment will be closely monitored with lysimeters to ensure that the volume of fluid leaching from it meets Wisconsin Department of Natural Resources (DNR) requirements. For any exceedance, Waupaca must provide an evaluation of the cause, as well as a chemical analysis of the fluid collected and a proposed response to reduce the excess leachate. DOT will place a clay cap over the fill, but no other precautions are required for the reuse of foundry sand as structural fill under existing DNR regulations.

### Relevant Regulatory Framework in Wisconsin

Wisconsin provides for foundry sand reuse in the state Administrative Code Chapter NR 538, entitled "*Beneficial Use of Industrial By-products*." This regulation establishes the performance standards and acceptable uses of industrial by-products, primarily ferrous foundry sand, ferrous foundry slag, and coal ash. (Standards for other materials are determined on a case-by-case basis in coordination with DNR.) Materials are classified by category, with



Category 1 being the most benign. The category determines which reuses are acceptable. Generally, materials classified in higher categories will require greater containment and will be acceptable for fewer reuses.

To qualify for Category 1 or 2 and be acceptable for a wide range of uses, materials must meet standards for both totals analysis (i.e., the composition of the material) and leachate tests (both quality and quantity). These materials must be tested frequently to ensure that they continue to meet the strict standards for these categories (e.g., to maintain a Category 1 classification, materials must be tested annually). To qualify for Category 3 or 4 and be acceptable for only a restricted set of applications, materials must meet only the leachate tests, with higher allowable contaminant levels. Category 3 and 4 materials also have less frequent testing requirements (e.g., once every five years for Category 4 materials). Materials also must be tested when there are significant changes in production processes. The sand from Waupaca has met Category 1 requirements for all constituents except arsenic and barium, which are at Category 2 levels.

The development of NR 538 was a joint effort among industry, DNR, DOT, and environmental groups, but was driven primarily by the foundry industry. This regulation substantially reduces the paperwork required for reuse of non-hazardous industrial waste (which is defined in NR 605). Under current regulations, only certain large projects (e.g., those involving more than 100,000 cubic yards of industrial by-products for embankment projects) require DNR concurrence to proceed. After completion of an embankment project, a site construction report must be submitted to the Bureau of Waste Management and to the local DNR field office, documenting the parameters of the project, soil testing data from specified sites during construction, and the institutional controls in place. A lysimeter, installed under the thickest portion of the embankment, is used to monitor the volume of the fluid leaching through the fill material. If more than 375 gallons of liquid is collected in a year, the company that provided the fill material must notify DNR and submit an evaluation of the reasons for the high volume, a chemical analysis of the leachate, and proposed action to reduce the volume of liquid leaching through the reused material.

Before finalizing the agreement with DOT for reusing its sand, Waupaca needed to obtain an initial certification. To receive its certification and a five-year exemption from hazardous waste regulations, Waupaca submitted an outline of its waste collection process and a characterization of the composition and physical properties of its sand. To maintain its certification for use in the construction of highway embankments, Waupaca must submit annual data on the production and use of its sand, including documentation that the sand continues to meet its classification category, plus a summary of any environmental monitoring results.

### **Product Performance**

Foundry sand is well suited for use as structural fill in highway construction, performing on par with fresh borrow or fill material. In fact, in areas with clay-rich soils, foundry sand may even be superior to borrow. Foundry sand also is superior to fly ash, another industrial by-product sometimes considered for this type of use. Fly ash has a higher silt content than sand,



which makes it more difficult to use. In addition, fly ash tends to qualify as Category 3 or 4 material under Wisconsin's regulations, thus being subject to more restrictions on reuse.

The sand from the Waupaca foundry is very uniform and not significantly different from virgin sand, except for being finer and smoother in texture and black in color. According to DNR, the dark color of the sand limits its potential use. Aesthetic considerations prevent the use of black foundry sand in any application that does not involve some type of cover or encapsulation. Thus, foundry sand has not been used in the full range of allowable applications for Category 2 industrial by-products, such as cold weather road abrasives.

The Wisconsin DOT reports no problems with foundry sand use in its construction projects. Monitoring is conducted for all large projects, and all lysimeter levels have been within DNR specifications. These results are not surprising because of the high level of bentonite in the foundry sand, which greatly reduces its permeability.

Officials at DNR note the importance of documenting compliance (of both foundries and reuse projects) and annual reporting in advancing and expanding beneficial reuse. DNR receives many questions stemming from public concerns over the reuse of foundry sand. The most effective approach to addressing them is to justify DNR's determinations and positions with solid data.

### **Economic and Operational Effects**

#### *Waupaca Foundry's Perspective*

For Waupaca Foundry, the costs of engaging in this beneficial reuse project with DOT are comparable to disposing of sand in the company-owned off-site monofill. When all transportation, monitoring, and maintenance costs are considered, the total cost of reuse is approximately \$9.00-\$9.25/ton. While this is somewhat higher than the up-front costs for monofilling the sand, there are future uncertain hidden costs associated with operating the monofill that tip the balance toward reuse. Waupaca estimates that the cost of reuse is similar to that of a commercial or municipal landfill, although some foundry sand customers receive cost breaks because the sand can be used as daily cover. Overall, though, the commercial or municipal landfill option is less preferable than either reuse or monofill disposal due to the potential future liability associated with disposing of sand in a landfill.

Waupaca's initial experiences with beneficial reuse of its foundry sands in the 1980s and early 1990s were not cost-effective. Facility processes used at the time required Waupaca to refine sand before reusing it. This step added significant cost to reusing the sand, making it more expensive than the monofill disposal option. However, general process improvements and increased reclamation of sand from baghouse ducts over the last 10 years at the facility have eliminated the need to process sand prior to reuse.

Transportation costs are a critical factor in the viability of reuse projects. For this project, 40 miles is about the maximum feasible transport distance, and then only if a local staging area is available. The staging area is needed because of differential trucking costs: for transporting sand to a state DOT construction site, a trucker must be paid at the "white sheet rate," which is

roughly \$10/hour higher than the rate a private contractor typically charges. By establishing a staging area close to the construction site, the sand can be transported most of the distance by a private trucker at a lower rate, and subsequently carried the remaining short distance to the actual work site at the higher rate. The ability to establish a staging area for this project depended on finding a willing landowner with a suitable location that allowed for control of surface-water run-on and runoff. Waupaca and DNR credit Waupaca's contractor for working closely with the local government and general public through a series of public meetings to ensure support for the storage and reuse plan.

#### *Department of Transportation's Perspective*

Virgin fill materials are cheap and widely available in Wisconsin, which reduces the economic attractiveness of the beneficial reuse of industrial by-products. The costs associated with the regulatory requirements, even for Category 1 materials, mean that the transportation and processing costs for the foundry sand must be significantly lower than those for comparable virgin material. However, in areas that have very high clay content, foundry sand can be a superior product for fill.

Since the overall cost to DOT of reusing foundry sand is comparable to that of using virgin fill materials (i.e., the cost of purchasing reused fill material is lower, but this is offset by the additional cost for the lining), DOT staff note that they make an effort to reuse foundry sand and other industrial by-products to help reduce the need for disposal of these materials in landfills. This is consistent with Wisconsin's emphasis on the reuse of material in state projects.

The primary concern for DOT in undertaking a project that involves the use of foundry sand is whether the promised material will be available. In a past project, the foundry could provide only half of the material initially promised. In that case, DOT had to make up the difference with borrow, resulting in significant additional costs.

## **REUSE OF FOUNDRY SAND IN ASPHALT PRODUCTION – MICHIGAN**

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### **Description of Beneficial Reuse Activity**

Resource Recovery Corporation (RRC) is located in the West Michigan town of Coopersville. RRC was created in 1990 to enhance the competitive advantage of West Michigan foundries through safe, dependable, and economic management of foundry residuals. RRC encourages participating foundries to increasingly employ sustainable business principles including reduction in use of materials entering the process residual stream, reclamation for internal reuse, and source separation to facilitate processing for beneficial use in other industries.

Beneficial use of foundry sand and other process residuals diverts materials from disposal in general refuse landfills and into other uses where they replace virgin resources. However, foundry sand is generally not suitable for reuse immediately after leaving foundry operations. To this end, RRC operates a sand processing facility where it reduces mold and core sand lumps, removes fines, recovers metallics, and screens the material to a specified particle size distribution. RRC also accumulates foundry slag at a site in nearby Muskegon, Michigan for crushing and subsequent use in the production of asphalt.

RRC is owned by 14 shareholder foundries who worked in cooperation with the Michigan Department of Environmental Quality (MDEQ) to establish the West Michigan operation. Much of the startup costs associated with the development of RRC were borne by the shareholding foundries and funded through the MDEQ Solid Waste Alternative Program grant program.

The sand processing equipment in Coopersville is located in a three acre Type III cell which is co-located within a 240 acre Allied Waste System Type II landfill. As a result, in addition to the processing capability, RRC also has access to long-term storage within the Type II landfill for future use and/or disposal of the residuals. Unusable residuals received by RRC, such as dusts and commingled wastes, are disposed of in Allied's landfill. The major focus of this project is the production of fine aggregate for use in asphalt manufacturing at a nearby Muskegon batch plant. This asphalt batch plant was upgraded specifically to use foundry sands and slags in the asphalt mix. Fine aggregate from the RRC facility is also sold to Allied for use as leachate collection system liner cover in the construction of new Type II landfill cells. The

entire operation is controlled from a free-standing facility located within the landfill boundary near the processing site.

In 2001, RRC sent over 31,000 tons of processed foundry aggregate to Asphalt Paving, Inc., (API) located in Muskegon, Michigan. API began to incorporate processed foundry aggregate into asphalt in 1997 and had utilized over 125,000 tons of this material through December 2001. Processed foundry sand and slag totally displaced virgin aggregate in several mix designs including, but not limited to, residential, industrial, private, and municipal projects including streets, parking lots, and tennis courts.

### **Regulatory Framework in Michigan**

The beneficial use of non-hazardous foundry sand in Michigan is governed by Part 115, Solid Waste Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, and its administrative rules.

Among the intended purposes of the recent rule change was the reduction of land filling in Type II municipal solid waste landfills and Type III industrial waste landfills, and the facilitation of beneficial reuses. The rules provide a number of alternative means for qualifying foundry process residuals for beneficial reuse. Under Part 115 and the new administrative rules effective October 9, 1993, with respect to beneficial reuses, low-hazard industrial wastes - which include foundry sand and other residuals - that meet the inert criteria may be utilized in asphalt, concrete, as fill material, and in other uses without petitioning the director of the MDEQ for an inertness designation. According to Section 11506, of Part 115, slag or slag products directed to a slag processor or to a reuser of slag or slag products are not solid waste.

Foundry process residuals must meet the one in a million risk calculated criteria in order to be eligible for uncontained uses, such as fill material and soil blending. To be eligible for contained uses, such as asphalt, concrete, or flowable fill, the residuals must meet the low-hazard industrial waste criteria - ten percent of the hazardous waste regulatory levels or 10 times the inert criteria, whichever is higher. These determinations are made based on testing for a multitude of chemical parameters using specific detection limits.

While sub-rules allow for the self-implementing reuse of low-hazard industrial wastes used as aggregates, the burden of proof that the materials qualify as low hazard lies with the generator. It is also possible to petition the director to designate a solid waste as an inert material when it is used as a substitute for virgin material. Under sub-rule designation, the director can approve the petition if the material does not pose a threat to groundwater and the conditions of reuse will prohibit exposures that result in unacceptable risks, as defined by rule. Essentially this means that leachate concentrations (TCLP, SPLP, or other approved test procedures) from the waste materials cannot exceed that of background soil, method detection limits, or groundwater criteria; nor can total concentrations on a dry weight basis as the material is reused exceed allowable human direct contact criteria. The material cannot pose a greater hazard to human health and the environment during reuse than the virgin material it replaces when used as a raw material in manufactured products.

## **Product Performance**

The processed foundry residuals produced by RRC have worked well as fine aggregate substitutes for the virgin quarried material in hot asphalt mix designs. The processed aggregate has also worked well as a substitute for virgin aggregate in leachate collection applications in municipal solid waste landfills. The proportion of foundry residuals utilized in asphalt varies widely by mix design and the application for which the asphalt is produced. As much as 37 percent sand and 23 percent slag have been utilized in some mix designs. Typical proportions for most asphalt applications are roughly 10 percent for sand and 15 percent for slag. In all cases, the processed foundry residuals used totally displaced virgin aggregate.

## **Economic and Operational Effects**

### *RRC's and Foundries' Perspectives*

RRC operates as a cooperative to reduce disposal costs for the foundry industry in West Michigan. While RRC is a for-profit consortium, the goal of the organization has been to reduce costs for foundries in an environmentally responsible manner rather than to develop into a highly profitable venture. Foundries benefit economically and environmentally due to the innovative and responsible handling of these residuals.

When RRC was founded in the early 1990's, local landfill tipping fees were increasing dramatically from approximately \$3.00 per ton to over \$20.00 per ton. Currently, shareholder and non-shareholder foundries pay approximately \$1.50 to \$13.00 per ton for reuse and/or disposal of their residuals. Transportation costs vary based on proximity and type of truck required to transport their materials. RRC receives sand from within a 90 mile radius; beyond this distance the costs of transportation become prohibitive.

At present, RRC is able to effectively market all of the foundry process residuals it produces. Despite this, RRC is always working to develop additional suitable and sustainable end uses in both high- and low-end applications for processed foundry residuals through research and development. RRC is especially interested in developing applications for foundry process fines and is also interested in working with the MDEQ to expand the list of accepted applications for these recyclable materials.

### *End User's Perspective*

RRC markets processed foundry materials (processed sand and slag) for \$2.00 to \$4.00 per ton. The cost of comparable virgin materials is slightly more than RRC's processed materials in this naturally "sand rich" area. The consumers of this material utilize foundry process residuals because they meet their specifications, exhibit consistent uniformity, and provide a low cost recycled alternative as compared to virgin materials.

## **REUSE OF FOUNDRY SAND AS PARKING LOT FILL – WEST VIRGINIA**

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### **Description of Beneficial Reuse Activity**

In West Virginia, HK Casting is one of the major foundries in a small local industry. Roughly a dozen casters operate in West Virginia, using a variety of metals and sands and servicing a wide mix of markets.

HK Casting, with 38 employees, casts about 10,000 tons of iron a day. The casting uses about 100 tons of sand per day. Eighty-five percent of the sand is reclaimed into the casting operation. The remaining sand (15 tons per day) goes into an overage area prior to disposal or external reuse. Currently, they reuse sand primarily as sub-base for parking lots. In the past several years, HK has used 21,000 tons of sand in this manner, providing material for new parking lots: one at the Weston Ford dealership located near the foundry, and a second at a local senior center. A third reuse project is planned in an additional parking lot at the Ford dealership.

HK Casting was a key player in working with the West Virginia Department of Environmental Protection (DEP) to establish a foundry sand beneficial reuse policy. With the assistance of West Virginia University, HK compiled information on reuse policies in other states and shared it with the DEP to help in developing the new state guidelines. According to DEP personnel, HK is the only foundry in West Virginia currently reusing sand under the agency's recently established guidelines.

### **Relevant Regulatory Framework in West Virginia**

West Virginia instituted new foundry sand beneficial reuse guidelines in 2000. Each reuse project requires the submission of a reuse plan that includes the use, the use location, the amount of sand proposed for reuse, and a sampling and analysis plan. The DEP reviews the project and inspects the reuse site.

The guidelines require certain buffer distances to limit potential leaching of constituents from the fill material. The primary concerns are that the project must not be within a 100-year floodplain and that it must be sufficiently far from intermittent or perennial streams, ponds, wetlands, and drinking-water sources.



The sampling and analysis plan addresses the chemical analysis requirements, including initial and annual testing. The required chemical analyses (TCLP and total metals) specify thresholds for 13 elements and two compounds. The thresholds for metals evaluated by TCLP in the guidelines are set at one percent of the toxicity values for hazardous waste under RCRA (40 CFR 261.24). Total metals analysis is required for copper, molybdenum, nickel, and zinc. Before the foundry requests approval to undertake a reuse project, it must have a sand sampling and analysis plan for TCLP and total metals accepted by the DEP. TCLP and total metals analysis are required initially, and on an annual basis thereafter. The facility must keep records of the analyses for at least five years.

The West Virginia guidelines encourage waste minimization and internal reclamation over external beneficial reuse programs: “Generators of foundry sand should actively pursue and implement all feasible alternatives to reduce the volume and toxicity of such waste, as well as explore on-site recycling, or recovery, before evaluating potential beneficial uses of the material.”<sup>3</sup> However, external beneficial reuse is preferable to disposal, and the guidelines specify eight categories of acceptable reuses. Numerous reuses are covered, including manufacture of a variety of new products, anti-skid material, structural fill, and sub-base or embankment fill. The guidelines also specify sand storage requirements, which include erosion and runoff control practices and siting. Also, storage is limited to one year, unless specific DEP approval is obtained.

For the parking lot projects, no additional testing is required at the site, except for initial verification of its suitability based on distances from water sources and ability for runoff and erosion control. While no specific leachate testing is required, the DEP does have the authority to inspect and monitor the reuse site any time before, during, or after a beneficial reuse project.

In discussing the regulation of used foundry sand, HK Casting emphasized the importance of requirements for testing sand and tracking its use. Such requirements ensure that the reuse program will remain viable and that it can be self-promoting, and enable state organizations and trade groups to demonstrate the advantages of beneficially reusing foundry sand.

### **Product Performance**

HK Casting and Weston Ford view this endeavor as mutually beneficial. HK Casting arranged for all the testing and paperwork, and then transported the sand to the project site. Neither party charged any fees. Weston Ford reports that the material has met all specifications and requirements, and it has observed no adverse effects from reusing foundry sand as fill in its parking lot. The two parties plan to undertake a second project in 2002 on an adjacent site owned by Weston, if permitting issues unrelated to the foundry sand reuse are resolved. The West Virginia DEP has been satisfied with the results of both reuse projects that HK Casting has completed (the initial project at Weston Ford and the project at the senior center).

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<sup>3</sup> West Virginia Spent Foundry Sand Beneficial Use Guidelines, Section I.



## Economic and Operational Effects

### *HK Casting's Perspective*

The incremental costs for processing sand are small. To prepare its foundry sand for reuse, HK Casting must screen for metals and break up any large lumps present in the sand. However, HK already uses the same processing steps for reclaiming sand within the foundry. In addition, no major changes were necessary for transporting the sand, because the foundry already owned a truck and loader.

In keeping with state requirements for beneficial reuse, HK tests its sand annually to verify that it meets the appropriate thresholds. Before reusing its sand, the state guidelines required HK Casting to conduct a TCLP analysis to certify that the sand was a non-hazardous waste for disposal. However, the state did not require a total metals analysis.

Overall, while HK has incurred some additional costs associated with more frequent testing and time spent on paperwork required for reuse, the cost savings associated with eliminating landfill fees for a portion of their foundry sand and lowering transportation costs have far outweighed these additional costs. Local landfill costs are approximately \$30 per ton, and the landfill HK previously used is about 25 miles away. Their current reuse project is located about one mile from the foundry. The savings to HK in landfill fees alone total \$630,000.

HK Casting's involvement in materials reuse in West Virginia began only two years ago, due to the lack of a state reuse policy before then. The owner of the facility has been involved in the foundry business for 45 years and has previously been engaged in reuse projects in other states where reuse was permitted. HK Casting is not expanding its reuse activities at this time, primarily due to a limited quantity of sand available on-site for reuse.

### *Weston Ford's Perspective*

Weston Ford was unaware of the potential to reuse foundry sand prior to being contacted by HK Casting. Weston is very satisfied with its involvement in the reuse project, particularly since it received the materials for its parking lot construction free of charge. Otherwise, Weston would have needed to purchase new fill material.