SPENT FOUNDRY SANDS

Rescuing Useful Materials From the Waste Stream

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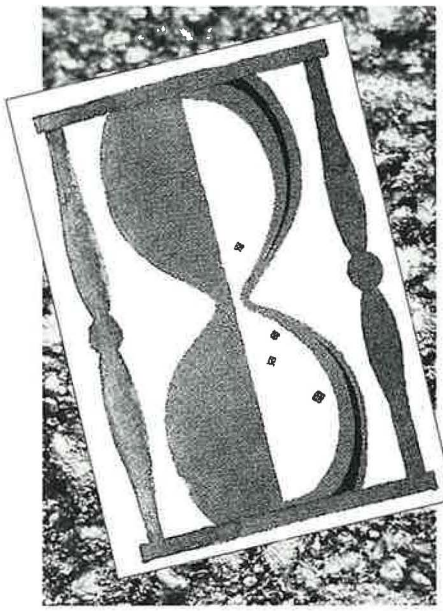

The casting of metal parts is a major industry in a number of regions in the United States, especially the Midwest, where metal parts for the automobile industry are produced in abundance. For technical and economic reasons, molds and cores for metal casting are composed of a combination of sands and additives. In the green-sand molding process, additives include a small percentage of bentonite, which acts as a binder, and combustible additives such as seacoal. In the shell-molded or chemically bonded casting process, small amounts of organic material and chemicals are added.

Casting molds and cores are broken down, rejuvenated, remixed, and reused until the parameters of the original materials are so modified that the material must be discarded and a new batch introduced. Depending on the size of the foundry, the discarded material can amount to tens or even hundreds of tons per day of operation. Some foundries operate monofills for disposal, and others are forced to use municipal solid-waste landfills. In either case the disposal costs are significant and may seriously compromise the competitive position of the foundry.

When little information about a waste product is available, a public agency can use that product only if the generator assumes complete liability for the consequences of use. In other words, the generator must indemnify the material on delivery. The more desirable alternative is to study the material's physical, mechanical, chemical, and environmental properties and impacts. Thorough knowledge of materials can then qualify them to be tested in demonstration projects. In Indiana the green sand retrieved from ferrous castings has been qualified for two uses: embankment and flowable fill. The environmental safety of spent foundry sands depends on the additives initially used with the sand and on the metals that are cast. Leaching tests are used to evaluate the presence of heavy metals in the sands. Questions remain about the need for additional environmental testing. Among the tests being considered is a non-chemical-specific test involving the response of living organisms to the leachate. Most spent ferrous green sands produce an acceptable response from bacteria, which is evidence to support recommending these materials for use in initial demonstration fills.

EMBANKMENTS

Spent green sand has a claylike texture and may be treated the same way as naturally occurring clayey sands in design and construction. Since the spent foundry sand cannot sustain vegetative growth, it should at least be covered on the side slopes with natural soil.

Demonstration projects should be sited in environmentally insensitive areas. It may be advisable to either monitor the leachate reaching groundwater or essentially eliminate leachate by compacting a fine-grained encasing layer of 0.6 to 0.9 meters (2 to 3 feet) in thickness on the side slopes. The spent green sands from ferrous castings are expected to pass Toxicity Characterization Leaching Procedure tests and bioassays with bacterial sensing organisms.

Individual foundries or associations of foundries are likely to be the primary advocates for reuse of spent foundry sands, and may make the material available free of charge at disposal sites, perhaps offering to haul sands at no cost to nearby construction sites. Total costs for using these sands may be significantly lower than for natural soils.

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Spent green sands from ferrous castings can be used in place of natural sand in flowable-fill mix.

Flowable Fill

A relatively new, gravity-placed grout material, flowable fill is gaining widespread popularity as a replacement for compacted soil. It is especially popular for backfilling trenches and other hard-to-compact locations. Such fill should flow easily in construction and should gain sufficient strength to be walked on and covered up within a day. However, its ultimate unconfined compressive strength should be below 1035 kPa (150 psi) to allow the fill to be excavated in the future if necessary. Although most flowable-fill mixes are currently designed to incorporate marketable components such as water, cement, Class C fly ash, and natural sand, recent research shows that currently nonmarketable components such as Class F fly ash and coal-combustion bottom ash may be used. Spent green sands from ferrous castings may also be used in place of natural sand in flowable-fill mix.

Flowable-fill mixes are marketed by ready-mix concrete producers. Since spent green sands are actually black, producers may require separate storage and even dedicated mixers to avoid color contamination of regular mixes. As is the case for embankments, the spent foundry sands would likely be delivered by the generator to the producer without charge, assuming the distance between the two is not prohibitive.