Casting Emission Reduction Program

Prepared by:
TECHNIKON LLC
5301 Price Avenue ▼ McClellan, CA, 95652 ▼ (916) 929-8001
www.technikonllc.com

US Army Task N256

Alternate Use of Sand

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EPA United States Environmental Protection Agency

CISA

AFS AMERICAN FOUNDRY SOCIETY, INC.

USCAR UNITED STATES COUNCIL FOR AUTOMOTIVE RESEARCH
DaimlerChrysler Ford Motor Company General Motors

ALTERNATE USES OF SAND

WBS: 4.1.1

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Reviewed and Approved by: _____William C. Walden_____ Date:_____

1.0 **Background and Objective**:

1.1 **Background**: The primary mission of the Technikon foundry is to improve foundry technologies that strengthen the U.S. casting industry's competitiveness while striving for near zero effect on the environment. The Technikon foundry is a state of the art foundry designed to provide laboratory data accuracy at production line rates. The foundry is capable of pouring up to fifty molds per hour in gray and ductile iron. Approximately every three to four months, spent foundry sand must be replaced with new sand to meet casting quality and environmental testing requirements. This sand replacement requirement generates nearly 80 tons of spent foundry sand. Additionally, normal foundry operations generate one to two tons of spent foundry sand per month. The spent foundry sand is collected in roll-off bins and transported by a waste management company to a licensed landfill.

1.2 **Objective**: The objective of this effort is to identify and establish environmentally beneficial uses for spent foundry sand that would otherwise become useless landfill. The method selected for beneficial reuse is based on consideration of amount of sand generated, local market availability, how the sand will be used, testing requirements, cost benefit and the logistics of moving the sand to the end user.

1.3 **Regulatory Requirement**: There are no specifically applicable Federal or California statutes or regulations governing the beneficial reuse of foundry sand. However, in order to ensure that requirements are met prior to seeking beneficial reuse opportunities, a regulatory analysis must be made.

1.3.1 **Classification Procedure**: Proper classification of the sand must be performed using the following procedure, which is specified in California and Federal Solid and Hazardous Waste Regulations:

- **Is it a solid waste? (40 CFR part 260, Appendix 1, Figure 1)**: It is a solid material that has served its intended purpose and is a manufacturing by-product. Therefore, the sand is a solid waste.

- **Is it a hazardous waste? (40 CFR part 260, Appendix 1, Figure 2)**: The sand does not exhibit any characteristics of toxicity, nor does it contain any wastes listed in 40 CR Subpart C. This classification is based on analytical data from appropriate tests performed on representative samples of sand generated at Technikon [The California Waste Extraction Test (WET) and the Soluble Threshold Limit Concentration (STLC)]. Therefore, the sand is not a hazardous waste.

1.3.2 **Classification of Technikon Sand**: Technikon sand is a solid waste; it is not a hazardous waste. According to Federal and California regulations, solid waste can be recycled or reused if the reuse activity involves using the waste in the manufacture of a product and does not result in use constituting disposal.

1.4 **Beneficial Uses of Foundry Sand**: Many states have developed beneficial reuse programs and regulations that allow spent foundry sand to be put to productive use. Sand that can no longer be used in the foundry process becomes available for beneficial reuse. Some of the areas in which spent foundry sand can be successfully marketed or recycled include:

- **Structural/Sub-Base Fill**: Structural/sub-base fills are applications where foundry sand has been beneficially used as structural fill, embankment material, granular backfill, roadway sub-base, and roadway base material.

- **Flowable Fill**: Flowable fill is an application where foundry sand has been used in the production of low strength fill material. Flowable fills are self-leveling liquid like materials made from a mixture of sand, fly ash or cement and water that cure to the consistency of clay. Applications for low strength flowable fills include utility trenches, building excavations, underground storage tanks and slab jacking.

- **Concrete and Related Products**: This is an application where foundry sand has been used in the production of concrete bricks, pre-cast concrete such as blocks and construction of pavement.

- **Asphalt**: This is an application where foundry sand has been used in asphaltic (bituminous) concrete consisting of a mixture of aggregates bound together by asphalt cement.

- **Soil Amendments**: Soil amendments are applications where foundry sand has been used in agricultural soil amendments. These soil mixtures used by the nursery industry are typically sand mixed with peat, fertilizers and topsoil. The presence of clay in the sand is beneficial because clay increases the capacity of soil to retain nutrients and water.

- **Portland Cement**: Portland cement application where foundry sand has been used in the production of Portland cement (concrete). Concrete consists of a mixture of 30% sand, 50% gravel, 15% cement and 55% water. Concrete can be cast-in-place or pre-cast into concrete products such as bricks, pipes and blocks.

- **Landfill Liners and Covers**: These are applications where foundry sand has been used as landfill liners and covers. A large proportion of foundry sand disposed in landfills is sand composed of silica and bentonite. The sand-bentonite mixture makes the foundry sand potentially useful as liners and top covers.

2.0 **Methodology**:

2.1 **Investigate Alternative Uses of Green Sand**:

2.1.1 **Identify Optimal Reuse Strategies**: Compared to larger production foundries, Technikon does not generate large amounts of spent foundry sand. The selected reuse strategy should encompass minimum impact on production staff, cost avoidance, and minimum logistics costs with respect to transporting the spent foundry sand to the end user. The aim then, is to identify a beneficial and cost effective local use for relatively small amounts of spent foundry sand.

2.1.2 **Identify Local Market for Used Foundry Sand**: The various uses for foundry sand identified in section 1.4 were researched and a local market for landfill liner and top cover material was identified through contact and coordination with:

- County of Sacramento Waste Management of Sacramento Division, Kiefer Landfill.

- Waste Management of Sacramento: Current contract provider for collection and transportation of Technikon spent foundry sand to landfill.

2.2 **Set Up Optimal Reuse Process**:

2.2.1 **Current Process**: Currently, spent foundry sand is collected in roll-off bins provided by Waste Management of Sacramento. When the bins are full, Waste Management of Sacramento is contacted to haul the used sand to a licensed landfill. In addition to hauling fees Waste Management of Sacramento passes on to Technikon a disposal fee of $7.50 per ton that is charged by the landfill operator.

2.2.2 **Beneficial Reuse of Spent Foundry Sand**: The County of Sacramento Waste Management and Recycling Division will accept spent foundry sand to use as top cover at their Kiefer landfill facility. Because the use of the spent foundry sand will be recycled as top cover Sacramento County does not charge a disposal fee. This arrangement will eliminate the $7.50 per ton disposal fee previously paid by Technikon. The Kiefer Landfill will accept sand that meets their testing requirements as discussed in section 2.2.3.

2.2.3 **Sacramento County Kiefer Landfill Test for Reuse**: In order to determine whether the foundry sand generated by the Technikon facility is acceptable for use as landfill cover, the sand must be classified according to applicable Federal and California rules. This involves conducting outside lab analysis on a representative sample of the sand using approved analytical procedures specified by California EPA's Department of Toxic Substance Control (DTSC).

2.2.3.1 **Test Procedure**: Briefly, the analytical procedures test the sand for leachable pollutants of concern. Pollutants of concern include those pollutants identified in applicable rules (primarily from drinking water standards) and that Technikon, as the generator of the sand, suspects to be present in the sand. For example, polychlorinated biphenyls (PCBs) are on the list of pollutants of concern, but Technikon can certify that its sand contains no PCBs. Conversely, certain organic compounds are on the list of pollutants of concern, and Technikon suspects that its sand contains those pollutants at some level. The sand was tested for all listed suspected pollutants at specified detection limits.

2.2.3.2 **Test Results**: The test results indicate that the used foundry sand exceeds the limits for iron and aluminum allowed by the Keifer Landfill. Consequently, the Kiefer Landfill will not accept the spent foundry sand.

2.2.4 **Sand Collection and Hauling**: Sand collection and hauling will continue to be performed under existing contract by Waste Management of Sacramento.

3.0 **Results and Future Development of Reuse Program**:

3.1 **Results**: Because the Kiefer Landfill can not accept the spent foundry sand Waste Management will continue taking the spent foundry sand to an approved landfill. Waste Management is currently researching methods for beneficial use of the spent foundry sand.

3.2 **Future Development of Reuse Program**: Coincident to developing a sand reuse program with Waste Management, Technikon and GF Industries of Brea California are investigating using spent foundry sand in the manufacture of concrete building bocks. The GF Industries operation in southern California has successfully processed spent foundry sand into concrete products for a number of years and is actively working with Technikon to build a Northern California market for their sand reuse process. At this time, GF Industries is at the beginning stages of developing the customer base, processing and logistics infrastructure for their Northern California sand reuse program. Once the sand reuse program is in place, Technikon will have the option of continuing with Waste Management or sending the spent foundry sand to GF Industries for use in the manufacture of concrete blocks.