ACTIONS AIMED AT INCREASING

THE BENEFICIAL USE OF FOUNDRY SAND

A MULTI-STAKEHOLDER ACTION PLAN

September, 2009

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Over the past year, a core planning group has worked in consultation with a broad group of stakeholders, to consider various actions for increasing the beneficial use of foundry sand. This process has produced a Multi-Stakeholder Action Plan (MAP) which identifies key challenges to increased beneficial use, and a comprehensive set of actions aimed at increasing the beneficial use, of foundry sands. These actions will a) document the economic and environmental case for beneficial use, b) foster sustainable markets linking sand generators with end users, c) address regulatory processes, and d) establish a coordinated framework to oversee implementation and measure progress.

The planning process also generated a set of Initial Priority Actions that various key parties are undertaking over the next few years. These actions will address many of the challenges identified in the MAP and lay the groundwork for implementation of additional MAP actions.

Currently, the foundry industry estimates that about 28% of sands are directed to beneficial use. The industry's national trade association—the American Foundry Society—has set a goal of 50% beneficial use by 2015. During the development of the MAP, the stakeholders listed below expressed support for this goal and committed to work together towards achieving it through implementation of the Initial Priority Actions.

Organizations Playing Key Roles Implementing the Initial Priority Actions

American Foundry Society
American Foundry Society-Foundry Industry Recycling Starts Today (AFS-FIRST)
USEPA, Office of Policy, Economics, and Innovation
USEPA, Office of Resource Conservation and Recovery
USEPA Region 3, 4, 5, and 9
Federal Highway Administration, Pavement Technology Division
Federal Highway Administration, Resource Center
United States Department of Agriculture, Agricultural Research Service
United States Department of Agriculture, Cooperative State Research, Education, and Extension Service
Beneficial Use Task Force of the Association of State, Territorial, Solid Waste Management Officials
Michigan Department of Environmental Quality
Recycled Materials Resource Center
American Association of State Highway and Transportation Officials
Mulch & Soil Council
United States Composting Council
ASTM International
American Public Works Association
National Association of County Engineers

THE MULTI-STAKEHOLDER ACTION PLAN (MAP) FOR INCREASING THE BENEFICIAL USE OF FOUNDRY SAND

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INTRODUCTION

Industrial byproducts that historically have been disposed of are now being considered for beneficial use. Beneficial use can reduce our nation's carbon footprint and consumption of virgin materials, *and* result in economic gains. It is an important component of the nation's solid waste management hierarchy that first promotes source reduction or waste prevention, followed by reuse, recycling, energy recovery, and disposal.

Foundry sand from iron, steel, and aluminum foundries is a prime candidate for beneficial use (see Appendix 2 for a brief discussion of the physical, functional, and risk characteristics of these sands). Its recycling can result in cost savings for both foundries and end users, while also leading to a net reduction in greenhouse gas emissions and raw material extraction and consumption. Furthermore, a draft USDA/USEPA risk assessment of foundry sands from aluminum, iron, and steel foundries indicates that most of these foundry sands are safe for beneficial uses including manufactured soils in residential settings.[1]

As much as 9-10 million tons of sand are discarded by foundries in the United States each year. This sand has been used to form the molds into which molten metals are poured, thereby producing everything from kitchen faucets to engine blocks. Although the sand is used multiple times in the foundry, eventually it must be replaced in order to maintain proper grain size. Once its useful life at the foundry is reached, sands that meet environmental criteria can be beneficially used as fill in road and building construction, as an ingredient in cement or asphalt, and in soil blends for landscaping and horticulture.

Currently, the foundry industry estimates that about 28% of sands are directed to beneficial use. USEPA has estimated that this beneficial use is "saving 212 billion BTUs of energy per year…enough to provide electricity to over 5,500 houses a year. In addition, [it is] preventing 20,000 tons of CO2 emissions. This is equivalent to taking 3,382 cars off the road for a year."[2]

The industry's national trade association—the American Foundry Society—has set a goal of 50% beneficial use[3] by 2015, which will almost double these environmental benefits. USEPA and other stakeholders support this goal and commit to working with the industry to achieve it through implementation of the priority actions identified in this document.

Significant investment by industry and government agencies in research and demonstration projects has enabled many foundries to successfully recycle foundry sands. Nonetheless, in order to reach the 50% goal by 2015, more must be done to ensure that research results, case studies, and economic and environmental benefit information is made available to a broader range of stakeholders. As important, new efforts are needed to develop and disseminate information about sand characteristics and to better identify markets for individual foundries and sources of sand for individual end users.

This Multi-Stakeholder Action Plan (MAP) provides an overview of the actions most needed to increase beneficial use of safe, functional foundry sands from aluminum, iron, and steel foundries. Part 1 of the plan lists a set of Initial Priority Actions stakeholders are undertaking, and describes the Steering Group that will keep track of and guide implementation. Part 2 presents the challenges stakeholders need to address and an array of actions that should be undertaken to maximize beneficial use over the long term.

A "core planning group" composed of representatives from the USEPA, the American Foundry Society – Foundry Industry Recycling Starts Today (AFS-FIRST), and the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) Beneficial Use Task Force prepared the MAP through discussions with, and written input from, a broad range of stakeholders (see Appendix 1 for a list of organizations that contributed to the effort). Following the identification of the general challenges and accompanying actions, the planning group and other stakeholders prioritized activities and compiled the list of Initial Priority Actions.

[1] USEPA, US Department of Agriculture, Ohio State University, "Risk Assessment of Spent Foundry Sands in Soil-Related Applications, Peer Review Draft", May 2009 (formal peer review to be conducted in August – September 2009).
[2] USEPA presentation at the Foundry Sands Soil Forum, July, 2008 (Columbus, Ohio).
[3] The AFS survey did not include alternative daily cover for municipal landfills. To remain consistent, the 50% goal also does not include alternative daily cover.

PART 1 – INITIAL PRIORITY ACTIONS STAKEHOLDERS ARE UNDERTAKING

Chart of Initial Priority Actions

The chart below sets forth the Initial Priority Actions that stakeholders are undertaking. (A list of the chart acronyms follows the chart.)

Initial Priority Actions Stakeholders Are Undertaking	Lead Entity	Additional Entities	Completion
The USEPA/USDA Risk Assessment			
1. Complete final Foundry Sands Risk Assessment	USEPA/ORCR	USDA/ARS	TBD
2. Develop "laypersons" summary of the Assessment	USEPA/ORCR		TBD
3. Develop training tools (e.g., webinar) targeting state regulators and end-users regarding the findings and implications of the risk assessment	USEPA/ORCR, USEPA R5	ASTSWMO-BUTF	TBD
The 50% Goal and making the business case to foundries			
4. Implement industry communications strategy[1], including completing and disseminating the Beneficial Use Guide[2]	AFS, AFS-FIRST		Ongoing[3]
5. Conduct industry survey in consultation with the Steering Group	AFS, AFS-FIRST, Steering Group		6/2012
Web-based tools: www.FoundryRecycling.org and the GIS mapping tool			
6. Redesign/update the www.foundryrecycling.org website, including adding search capabilities to the technical library, updating index/summaries of risk studies, and updating state regulatory profiles	AFS, AFS-FIRST	ASTSWMO-BUTF	1/2010
7. Develop web-based GIS mapping tool to serve function of connecting end users and foundries	USEPA/OPEI, AFS-FIRST	USEPA/ORCR	1/2010
Road/construction end uses: fact sheets, guidance, specifications, outreach			
8. Develop technical fact sheets addressing basic physical and environmental characteristics and specific end uses (hot mix asphalt, base and sub base, structural fill, and flowable fill)	RMRC		1/2010
9. Develop case-studies for bases & sub-bases, blended bases, and structural fill	AFS-FIRST		1/2010
10. Take lead in moving IN-DOT structural fill and embankment specifications through AASHTO	AASHTO		8/2010
11. Take lead in moving hot mix asphalt specification through ASTM	ASTM		6/2010
12. Outreach to engineers, state DOTs, and other construction end users (newsletter articles, webinars, conferences, etc.)	FHWA, Steering Group, USEPA Regions	RMRC, APWA, NACE	Ongoing
Soil-blending end uses: fact sheets, survey, outreach			
13. Engage and coordinate across the horticultural sectors (e.g., nurseries, soil blenders, composters, greenhouses, propagators) to identify and promote markets for foundry sand[4]	USDA/CSREES		Ongoing
14. Develop/conduct survey of end-users to identify potential for foundry sand market	MSC		1/2010
15. Implement education and outreach strategy for composting and soil-blending industries (e.g. a session, co-organized with USEPA Region 4, at the 2010 USCC annual meeting, sessions at other trade conferences, web links, trade journal articles)	Steering Group, USEPA Regions	USCC, MSC, USDA/CSREES	Ongoing

Actions at the State and local levels 16. Assess and initiate actions aimed at increasing sand use in strategic areas of the country; including canvassing top ten state cast metals associations and state regulatory agencies, prioritize states based on potential for sand reuse and states' beneficial use approval processes, promoting multi-stakeholder dialogue in connection with States' regulatory development efforts covering beneficial use, identifying opportunities for sand aggregation from multiple foundries, etc.	Steering Group, AFS-FIRST, USEPA Regions, FHWA	ASTSWMO-BUTF	Ongoing
The Implementation Steering Group 17. Establish a work group, made up of representatives of the lead organizations for each action and other interested parties, that meets (e.g., by conference call) every six months to coordinate and assist with implementation of these actions and any future MAP actions – See next page.	Rotating Chair	All with key MAP implementation roles	Ongoing

LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ASTM	ASTM International
APWA	American Public Works Association
AFS-FIRST	American Foundry Society – Foundry Industry Recycling Starts Today
ASTSWMO-BUTF	Association of State and Territorial Solid Waste Management Officers – Beneficial Use Task Force
FHWA	Federal Highway Administration
NACE	National Association of County Engineers
RMRC	Recycled Materials Resource Center
MSC	Mulch & Soil Council
USCC	United States Composting Council
USDA/ARS	United States Department of Agriculture, Agricultural Research Service
USDA/CSREES	United States Department of Agriculture, Cooperative State Resource, Education, and Extension Service
USEPA/Regions	United States Environmental Protection Agency Regional Office
USEPA/OPEI	United States Environmental Protection Agency, Office of Policy, Economics, and Innovation
USEPA/ORCR	United States Environmental Protection Agency, Office of Resource Conservation and Recovery

[1] This communication strategy is aimed at making the business case for beneficial use to foundries. It will include elements such as: an article on the goal and rationales for beneficial use in the trade journal *Modern Casting*; communication about the goal and rationales via AFS' *Econnections*; promoting the Beneficial Use Guide via AFS' *Econnections*; a section of the AFS website focusing on the business case; and development/delivery of a webinar focusing on these matters.

[2] The Beneficial Use Guide makes the case for beneficial use of foundry sand, and provides guidance on how to manage such sands. Ultimately, there may be a role for a document(s) that lays out in more detail "best" sand management practices for specific end uses. AFS-FIRST and the MAP Implementation Steering Group will monitor the need for, and potential opportunities for developing, such BMPs.

[3] Given the current state of the economy, many foundries may not be able to expend resources to develop a beneficial use for their sand (presumably, however, all would be interested in beneficial use if approached by an end user). The industry communication strategy will be implemented with this in mind; with some of the strategy's elements (e.g., the webinar) implemented when/where foundries have the financial wherewithal to capitalize on the information presented.

[4] This action will span a range of activities that may include sessions at ag-extension meetings; developing fact sheets covering sand characteristics, functionality, and management for relevant end uses; developing a template/form identifying key characteristics composters and other end users are looking for in sand.

The Implementation Steering Group

A key to significantly increasing beneficial uses of foundry sands is establishing a mechanism for coordinating, assisting, and guiding implementation of the Initial Priority Actions and, ultimately, other actions identified in the Part 2 of the MAP. An Implementation Steering Group will serve this purpose.

The Steering Group will have a rotating Chair and members who will plan and manage the group's communication and deliberations. Representatives of the lead organization(s) for each of the Initial Priority Actions will participate; sharing information about their efforts and providing input regarding potential related future actions. The Steering Group will hold conference calls every six months, and will communicate electronically between calls.

The initial make up of the Steering Group*:

Chair:	Susan Mooney, USEPA Region 5 (Chicago)
Members:	Dan Oman, AFS-FIRST Richard Benware, USEPA/ORCR (Economics and Risk Analysis) Truett Degeare, USEPA/ORCR (Resource Conservation and Sustainability) Jeff Hannapel, The Policy Group Elizabeth Olenbush, EO Associates Keith Chanon, USEPA/OPEI Bizhan Zia Sheikholeslami, ASTSWMO Beneficial Use Task Force Jason Harrington, FHWA (Office of Pavement Technology) Steve Mueller, FHWA (Resource Center) Tom Bewick, USDA/CSREES Jeffrey Melton, RMRC Cecil Jones, AASHTO Bob LaGasse, MSC Stuart Buckner, USCC John Yzenas, ASTM International USEPA Regional Representation

* There is a list of the acronyms on page 3.

PART 2 – A COMPREHENSIVE LIST OF CHALLENGES AND ACTIONS FOR INCREASING BENEFICIAL USE

Beneficial use of safe foundry sand makes sense from an economic and environmental perspective. So why is it not widespread? A number of factors contribute to its limited reuse. For example, some decision makers are not aware of its safe risk profile and the extent to which its physical characteristics make it suitable for a range of end uses. Some foundry managers are not aware of how the sands need to be managed and stored to meet end user needs. Markets are not well established in various parts of the country. And public policy is just beginning to promote beneficial use of industrial byproducts in much of the country.

Part 2 of the MAP outlines the key challenges to increased beneficial use of foundry sand and proposes a broad range of actions to respond to these challenges over the long term. The extent to which each of these challenges exists in a particular State or region varies, and implementation of the actions needs to be assessed and designed with this in mind.

The challenges and actions are organized into four overarching areas:

- Making the Case
- Creating Sustainable Markets
- Regulatory Processes
- Implementation: Coordination and Measurement

MAKING THE CASE

In some areas around the country, foundries, regulators, and end users are working together to beneficially use foundry sand with great success. In other areas of the country, however, the economic and environmental case for beneficial use is not well known by foundries, potential end users, regulators, and other decision makers.

Challenges:

1. *Increasing Awareness of The Business Case For Beneficial Use*. For a number of years, the American Foundry Society (AFS), the Federal Highway Administration (FHWA), the United States Environmental Protection Agency (USEPA), the United States Department of Agriculture (USDA), some state environmental and transportation agencies, as well as representatives from the business sector and academia have been highlighting the potential economic benefits of beneficial use of industrial byproducts. However, there is an opportunity—with the increased effort on the part of businesses to identify cost savings and environmental improvements—to refine the presentation of this business case and renew the effort of communicating it to a broader set of foundries, potential users, and other relevant decision makers.

2. *Communicating The Environmental Case For Beneficial Use*. Significant research has been conducted confirming the low risk to human health and the environment of using most foundry sand in various end use applications. However, the results of these studies have not been widely disseminated. Foundries, regulators, and end users all need this information to support their decision making regarding beneficial use. Furthermore, many foundries, regulators, and end users also need information regarding the environmental benefits that can result from beneficial use of foundry sand.

3. *Providing Information Regarding Sand Performance Characteristics For Various End-Use Applications*. Despite the successful reuse of an estimated 28% of foundry sand and the

implementation of a range of demonstration projects, many stakeholders have questions regarding the suitability of foundry sand for various end uses.

Actions:

A. ***Enhance and publicize www.foundryrecycling.org as the primary online resource for foundry sand recycling.*** Having an easily searchable and robust website is critical for responding to all of the challenges identified in this action plan. In the short term, improving the interface and search function for foundries, end users, and state regulators is essential.

B. ***Compile existing, and develop new, information materials and maintain them in a single information repository.*** Develop the following types of materials to increase understanding of foundry sand's characteristics and risk profile, raise awareness of foundry sand beneficial use applications, and document the economic and environmental benefits:

i. ***Information on economic and environmental benefits (presentations, brochures, and other formats).*** Succinct summary information that can be adapted for use as a webpage, presentation, or brochure covering economic and/or environmental benefits for use with any/all audiences.[4]

ii. ***Risk research summary.*** Research focusing on the environmental and public health risks of foundry sand beneficial use needs to be summarized and made accessible to end users, regulators, and other decision makers.[5]

iii. ***End user fact sheets.*** Each end user community needs specific information about the characteristics of foundry sand. Each needs to see research data and demonstration project results that indicate foundry sands perform the same as or better than other materials used for the application. End users also need health and safety information.

iv. ***Case study library.*** Comprehensive case studies can provide information useful to all stakeholders. Key information includes: the management practices used in the foundry, the economic costs/benefits, the required environmental assessment and how the regulatory approval process works, any performance-related testing done, acceptance by the end user, and critical partnerships. Some case studies already exist. The focus over the next few years should be to fill in the gaps so that at least one comprehensive case study is available for each end use application.

v. ***DVD of foundry operations.*** Many stakeholders are unfamiliar with foundries, how they operate, and how sand is used in the metal casting process. A short DVD could effectively bring a large number of stakeholders into a foundry to improve understanding.

vi. ***Beneficial Use Guide.*** AFS is producing a guide to help foundries develop a step-by-step understanding of how to transition from disposing of sand to recycling it.

C. ***Develop and implement a communications strategy aimed at foundries, end users, regulators, and other key decision makers.*** Much of the communication necessary to increase beneficial use of foundry sand will need to take place in—and be custom-tailored to the specific circumstances of— specific state and local areas. However, some can be generic in content and nationwide in approach:

i. ***Presentations at foundry and end user conferences.*** Presentations and workshops at conferences provide an opportunity for direct communication with foundries and potential end users.

[4] Tools for obtaining such information include Life Cycle Models such as PaLATE and SimaPro.
[5] One source for such information is USEPA/ORCR's Risk Compendium.

ii. ***Information dissemination through end user trade associations.*** Articles in trade association publications, links from their websites, and other conduits can reach large numbers of potential end users.

iii. ***Multistakeholder workshops in key foundry states.*** Multistakeholder workshops in key foundry states can provide an opportunity for direct communication among foundries, potential end users, and regulators.

CREATING SUSTAINABLE MARKETS

Currently, in many areas of the country, foundries and potential end users and/or contractors have not identified one another or established long term business relationships. To help facilitate this, some basic information and tools can be developed and made broadly available.

Challenges:

4. *Improving Suppliers' and Users' Abilities to Locate One Another.* Foundries and potential end users do not have a simple means of identifying one another.

5. *Ensuring that Foundry Sands Meet End-Use Performance Requirements.* Currently, few standard specifications exist for foundry sand beneficial use applications. Specifications can address end users concerns about performance and can also be used by environmental regulators to ensure that foundry sand is used appropriately. At a minimum, commonly-accepted guidelines describing sand characteristics for various end uses would be helpful and could serve as a first step towards more formalized end-use specifications.

6. *Developing Storage and Processing Capacity To Support High Volume End-Use Applications*. Small foundries face challenges in supplying sufficient quantities of sand to meet some end users' requirements. The ability to aggregate and store sands from multiple foundries could enable its use in large construction projects in some areas of the country where this currently is not possible.

Actions:

D. ***Further develop the AFS mapping tool so that it can aid end users and foundries to locate one another.*** AFS has developed a first generation mapping tool that identifies foundries for use by potential end users as an aid in finding a source of sand. This tool can be enhanced to further aid both end users and foundries to find suitable "partners" given their sand types and end-use needs.

E. ***Establish sand characterization guidelines for most promising end uses.*** Many stakeholders see sand characterization guidelines—and ultimately, standard specifications and testing protocols—as a key to increasing sand use, both in construction and soil-blending applications.

F. ***Analyze successful models and potential options for addressing business and regulatory factors relating to sand aggregation and storage.*** A few entities have developed business models for aggregating sand from different foundries for use in larger construction projects. Identifying how this can be done in other areas of the country will be critical to significantly increasing beneficial use.

G. ***Convene multistakeholder workshops in key foundry states.*** Multistakeholder workshops in key foundry states can serve a number of critical purposes. Beyond general networking and information sharing, they can be structured to discuss specific potential end uses/projects with key parties. They also can serve as a forum for discussing sand aggregation opportunities that could enable smaller foundries to participate in supplying sand to larger construction projects.

REGULATORY PROCESSES

Each state environmental agency has the responsibility—and their own standards, criteria, and risk levels –for approving most beneficial uses of foundry sand. Up-to-date risk information is critical for supporting these determinations. Also, in some states foundries are unfamiliar with the regulatory approval process.

Challenges:

7. *Addressing States' Questions Regarding Risks*. State agencies need access to research results, sand characteristics data, and up-to-date risk evaluations to support development of regulatory programs and individual beneficial use approvals. States may also benefit from an understanding of other states' approaches and decisions.

8. *Supporting the Efforts of States In Developing Policies To Increase Beneficial Use*. Developing, implementing, or revising beneficial use programs for foundry sand requires state staff and resources. Building awareness of the connection between beneficial use and broader policy initiatives relating to sustainability, state-wide recycling or waste diversion goals, and climate change action plans may aid in supporting investment in a beneficial use program.

9. *Addressing Liability Concerns Regarding the Use of Foundry Sand.* Some end users may be reluctant to use industrial byproducts like foundry sand due to concerns about long term liability.

10. *Increasing Awareness of The Regulatory Approval Process.* Many foundries and end users are not clear about their state's regulatory approval program for evaluating beneficial use of materials such as foundry sand. This uncertainty may contribute to both foundries and end users not pursuing beneficial use.

Actions:

H. ***Provide opportunities for states to ask questions of USEPA and USDA researchers about the USEPA/USDA risk study.*** While many states have seen presentations on the results of USDA's foundry sand characterization and recommendations for use in soil applications, they have not had an opportunity to review the technical document and ask questions about the USEPA's risk assessment for foundry sand. Once the technical document is available to states, several information sessions should be held to facilitate state use of the research.

I. ***Convene multistakeholder workshops in key foundry states.*** See 'G' and 'C iii' above.

J. ***Provide support to state regulatory development efforts by increasing awareness of the connection to recycling and climate goals.*** Stakeholders should work with public agencies and legislative bodies to support regulatory development efforts aimed at increasing beneficial use of industrial byproducts. Stakeholders could develop and disseminate state- or municipality-specific information regarding potential climate benefits and recycling opportunities.

K. ***Compile and distribute information about Federal or State programs that address the liability issues in other contexts.*** Liability issues are not unique to the beneficial use of foundry sand. One example of a state's effort to address liability issues is Wisconsin's Act 88 which provides immunity from liability for the use of certain industrial byproducts in public works projects. An in-depth description of this and other relevant

State and Federal programs would provide a resource to those interested in addressing this challenge.

L. **Identify well-established end uses that are typically approved by a State's regulatory agency.** This will help simplify and focus marketing activities in the state as foundries will know which end-uses are most promising.

M. ***Support states in developing and using the NEWMOA State BUD Database.*** The Northeast Waste Management Officials' Organization (NEWMOA) is developing a database of beneficial use determinations (BUDs) to help member states improve their BUDs through sharing information. This database can serve as a valuable resource to states as they consider new beneficial use projects. See http://www.newmoa.org/publications/projdesc/2008/SW%20-%20BUDs.pdf.

N. ***Update and enhance the existing state profiles (found at foundryrecycling.org) for each of the top foundry states***. Foundries face a steep learning curve as they begin recycling their sand. A key element of this is familiarizing themselves with their states' regulatory approval processes. The state profiles can also provide insight to foundries and end users as to which end uses are well-established from the regulatory agency's perspective (see "L" above). They also can offer the ability to make cross-state comparisons of beneficial use approval processes, which will be helpful in prioritizing activities under this national effort to increase beneficial use of foundry sand. Information of this sort can be presented on www.foundryrecycling.org.

IMPLEMENTATION: COORDINATION AND MEASUREMENT

Stakeholders recognize the importance of coordinating implementation of this MAP and measuring progress towards the goal of 50% beneficial use by 2015. The following actions are aimed at accomplishing these objectives.

O. ***Establish a multistakeholder coordination and oversight working group***. A multistakeholder Steering Group should meet (by conference call or in-person, perhaps in connection with existing conferences) twice a year to assess progress on each of the actions outlined in this MAP.

P. ***Conduct foundry sand beneficial use surveys.*** In 2012, the foundry industry should conduct a survey to determine the progress being made toward achieving the goal of 50% recycling of available foundry sand by 2015.

APPENDIX 1 ORGANIZATIONS THAT CONTRIBUTED TO THE DEVELOPMENT OF THIS MAP

The Core Planning Group that took the lead developing the MAP was composed of:

U.S. EPA
Keith Chanon, Office of Policy, Economics, and Innovation
Truett Degeare, Office of Resource Conservation and Recovery
Susan Mooney, Region 5

Beneficial Use Task Force, Association of State, Territorial, Solid Waste Management Officials (ASTSWMO)
Duane Roskoskey, MI Department of Environmental Quality

American Foundry Society/Foundry Industry Recycling Starts Today (AFS-FIRST)
Dan Oman, RMT
Jeff Hannapel, The Policy Group
Elizabeth Olenbush, EO Associates

Facilitator and Document Drafter
John Lingelbach, Decisions & Agreements

Individuals from the following organizations provided input during the development of the MAP, participating on conferences calls and/or providing comments on drafts and discussing the challenges confronted by foundries, end users, and regulators; and the actions that can help address these challenges.

FOUNDRY INDUSTRY
Metal Technologies
Foundry Association of Michigan
Pennsylvania Foundry Association
AFS-Texas Chapter
Mathews International
Ohio Cast Metals Association
Indiana Cast Metals Association
Honda
American Foundry Society – Foundry Industry Recycling Starts Today
RMT, Inc.
Accurate Castings
Midland Manufacturing Co.
Waupaca Foundry

USEPA REGIONAL and HEADQUARTERS Offices
Region 3 (PA, DE, DC, MD, VA WV)
Region 4 (KY, TN, NC, SC, MS, AL, GA, FL)
Region 5 (IL, IN, MI, MN, OH, WI)
Region 6 (NM, TX, OK, AR, LA)
Region 9 (AZ, CA, HI, NV, Guam, American Samoa, Trust Territories, Northern Mariana Islands)
Office of Resource Conservation and Recovery
Office of Policy, Economics, and Innovation
Office of Pollution Prevention and Toxics

OTHER FEDERAL AGENCIES
Federal Highway Administration, Pavement Technology Division
Federal Highway Administration, Resource Center
US Department of Agriculture, Agricultural Research Service
US Department of Agriculture, Cooperative State Resource, Education, and Extension Service

STATE ENVIRONMENTAL AGENCIES

Indiana Department of Environmental Management
Wisconsin Department of Natural Resources
Michigan Department of Environmental Quality
Pennsylvania Department of Environmental Protection
Ohio Environmental Protection Agency
Texas Commission on Environmental Quality
New Mexico Environment Department
Louisiana Department of Environmental Quality
Virginia Department of Environmental Quality
Illinois Environmental Protection Agency
Alabama Department of Environmental Management

CONSTRUCTION and SOIL STAKEHOLDERS

Resource Recovery Corp
Associated General Contractors of America
National Association of County Engineers
Portland Cement Association
Recycled Materials Resource Center
American Public Works Association
Michigan Department of Transportation
Wisconsin Department of Transportation
Kurtz, Bros, Inc.
American Road and Transportation Builders Association
Phoenix Services
Beneficial Reuse Management
US Composting Council
Barnes Nursery
Paygro/Garick
Mulch and Soil Council
Penn State University
Ohio State University

APPENDIX 2 CHARACTERISTICS OF FOUNDRY SAND

Most foundries use sand to form molds in the production of metal castings. The molding sand is compressed around a pattern (for the cast part) and a series of channels are formed that allows molten metal to flow into the sand mold. If a cast part requires a hollow center, a sand core is inserted into the mold cavity to produce the void in the casting. Once the casting has cooled and solidified, it is separated from the mold in a process called shakeout. The sand is screened, cooled and then returned to the sand system for reuse within the foundry process.

Foundry sand is, by far, the largest by-product/"waste stream" generated by the foundry industry. For most foundries, sand accounts for 55 to 90 percent of the total waste stream.

There are two major types of foundry sand used in the molding process; "green" sand and chemically-bonded sand. Green sand, which makes up the larger percentage of the two, is generally made of silica sand (85 – 99%); bentonite clay (8 – 10%); sea coal (3.5 – 6%) (bituminous coal); and water (3-4%). Other minor ingredients (flour, rice hulls, starches cereals, etc.) may be added to adsorb moisture, improve the fluidity of the sand, or stiffen the sand, based upon the production needs of the individual foundry. The term "green sand" refers to the "green" or molding strength of the sand.

The other type of molding sand is broadly termed "chemically-bonded" sand. As the name implies, chemically-bonded sand is made by mixing silica sand with a chemical binder (1-5%) to form a mold or core. The most common chemical binders include phenolic-urethanes, epoxy, furfuryl alcohol and sodium silicate. The chemical binder acts as a glue to hold the individual grains of sand together. A catalyst may initiate the reaction that cures the chemical binder and hardens the sand core or mold. Heat may also be applied to harden the sand mixture. "Oil", "shell core", "shell mold", "hot box", "warm box", "cold box" and "no-bake" (or "air-set") are some of the generic names for chemically-bonded sands.

The vast majority of foundry sand—generated by iron, steel, and aluminum foundries—is nonhazardous and has a very low leaching potential for heavy metals and organics. Foundry sand generated by foundries that pour leaded brass or bronze alloys has the highest potential for exhibiting the toxicity characteristic. The USEPA estimates that only about 2% of the foundry sand generated in the US exceeds the hazardous waste characteristic for toxicity.

The recycling of safe foundry sand can save energy, reduce the need for virgin materials, and can reduce costs for both producers and end users. For example, in cold weather climates, use of spent foundry sands as construction site base material can extend the construction season because such sands won't freeze as readily as most soils. Regardless of the recycling application, foundries and foundry sand recyclers should consult state regulators to ensure that planned uses are consistent with state beneficial use and waste management programs and that the chemical and physical properties of the sand meet applicable state environmental limits, engineering performance criteria, and other state requirements. (For further discussion, see http://www.epa.gov/waste/conserve/rrr/imr/foundry/foundry-st.pdf.)

Unless deemed unnecessary by the end user, foundry sand that is reused beneficially is segregated from other by-product/waste streams generated in the foundry such as slags, refractory materials, baghouse dusts, and trash.

Risk Characterization

In 2002, the US Department of Agriculture's Agricultural Research Service (ARS) launched a collaborative research effort to determine if foundry sand can be safely used in agricultural or horticultural applications. Participating organizations included Pennsylvania State University, The Ohio State University, Purdue University, and USEPA.

The researchers concluded that beneficial use of non-olivine foundry molding sands from iron, steel, and aluminum foundries in soil applications presents no significant risk to human health or the environment.[6]

[6] Only a limited number of olivine sands were studied. More evaluation would be needed to support any overall conclusion regarding olivine sands

Using this research, USEPA conducted a risk assessment, and in August 2008, presented its preliminary finding—that when properly managed, non-olivine foundry sands from aluminum, iron, and steel foundries are safe for beneficial uses including manufactured soils in residential settings.

The objectives of the USDA collaborative research effort were to:

- characterize total metals, leachable metals and organic constituents in foundry sand
- evaluate the performance of foundry sand in soil blends including any impacts on soil microbes, plant health, nutrient availability, and leaching from foundry sand;
- evaluate risks of using foundry sand in soil applications and develop beneficial use guidelines that could be used by state environmental agencies to support beneficial use determinations.

Forty-three samples of foundry molding sands were collected from 37 foundries. Samples were taken from iron, steel, aluminum, and non-leaded brass foundries. Eighty-six percent of the samples were green sand. The samples were evaluated for metals, polycyclic aromatic hydrocarbons (PAHs) and phenolics, and dioxins. Laboratory, greenhouse, and field studies of manufactured soils blended with foundry sands were conducted. Potential exposures via food chain, soil ingestion, and ecological impacts were evaluated. The results of these characterizations and soil studies have been published in peer reviewed papers and have been presented at several conferences.

These recommendations were provided to the USEPA for evaluation. USEPA is conducting a conservative human health and ecological screening of the data provided by USDA's collaborative research effort. A draft document summarizing the USDA and USEPA evaluations was released for peer review in May, 2009.

This study builds on a large body of work evaluating foundry sands' environmental safety and performance in many end use applications, including asphalt, flowable fill, and road base. Previous published evaluations are available in the technical library at www.foundryrecycling.org.

Functionality Characterization – Construction Uses

Foundry sand has a number of potential uses within the construction industry. Use of sand from iron, steel and aluminum foundries in Controlled Low Strength Material (CLSM) or flowable fill, road embankments, road base, manufactured soil, agricultural amendments, and similar uses may be appropriate depending on the site and the sand composition. One of the largest uses is in the construction of embankments / structural fills associated with highway construction or with development. The material behaves much the same as native soil materials and if a foundry is located in close proximity to a construction site, foundry sand can present a very cost effective, alternative source of fill material. Other uses in the construction industry include:

- Fine aggregate for Hot Mix Asphalt
- Fine aggregate in Concrete
- Fine aggregate in masonry mortar mixes
- Raw material in the production of Portland Cement
- Fine aggregate in concrete block

Functionality Characterization – Soil Uses

More recently, foundry sands have begun to be used in soil applications. Foundry sand has been used in the manufacturing of the following soil-type products:

- Topsoil
- Potting Soil
- Compost
- Rain beds